INSECTICIDAL N-(HETEROARYLALKYL)ALKANEDIAMINE DERIVATIVES

This application claims the benefit of U.S. Provisional Application 60/526,760, filed December 4, 2003, and U.S. Provisional Application 60/609,590, filed September 14, 2004.

FIELD OF THE INVENTION

The present invention generally relates to pesticidal compounds and their use in controlling insects and acarids. In particular, it pertains to compositions of pesticidal N-(heteroarylalkyl)alkanediamine derivatives and agriculturally acceptable salts thereof, and methods for their use in controlling insects and acarids.

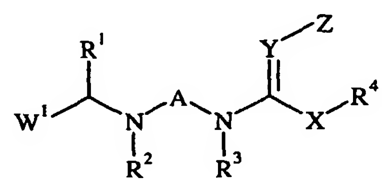
BACKGROUND OF THE INVENTION

It is well known that insects in general can cause significant damage, not only to crops grown in agriculture, but also, for example, to structures and turf where the damage is caused by soil-borne insects, such as termites and white grubs. Such damage may result in the loss of millions of dollars of value associated with a given crop, turf or structures. Although there are many orders of insects that can cause significant crop damage, insects, for example, of the suborder "Homoptera" are of major importance. The suborder Homoptera includes, for example, aphids, leafhoppers, cicadas, whiteflies, and mealybugs, to name a few. Homopterans have piercing/sucking mouthparts, enabling them to feed by withdrawing sap from vascular plants. Insect damage from homopterans is manifested in several different ways, other than damage caused by direct feeding. For example, many species excrete honeydew, a sticky waste product that adheres to plants upon which the insect feeds and lives. Honeydew alone causes cosmetic injury to crop plants. Sooty molds will often grow on honeydew, making food products or ornamental plants look unappealing, thereby reducing their cosmetic and economic value. Some homopterans have toxic saliva that is injected into plants while they are feeding. The saliva can cause plant damage through disfigurement and in some instances plant death. Homopterans can also vector disease-causing pathogens. Unlike direct

damage, it does not take a large number of disease-vectoring insects to cause considerable damage to crop plants.

Thus, there is a continuing demand for new insecticides, and for new acaricides that are safer, more effective, and less costly. Insecticides and acaricides are useful for controlling insects and acarids which may otherwise cause significant damage both above and below the soil level to crops such as wheat, corn, soybeans, potatoes, and cotton to name a few. For crop protection, insecticides and acaricides are desired which can control the insects and acarids without damaging the crops, and which have no deleterious effects to mammals and other living organisms.

A number of patents disclose some alkanediamine compounds that are reported to be insecticidally active. For example, US Patent 4,806,553 discloses certain insecticidal alkylenediamine compounds of the general formula I:



I

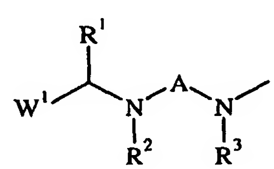
where

W^1 is a five- or six-membered heterocyclic group, which may be substituted, containing at least one heteroatom selected from -O-, -S-, and -N-;

R^1, R^2, and R^3 are hydrogen or alkyl;

R^4 is hydrogen, alkyl, aryl, aralkyl, alkoxy, dialkylamino, alkoxyalkyl, alkylthioalkyl, or $-CH_2-W^2-$ in which $W^2 = W^1$;

X is -S-, $-NR^5-$, or a single bond, in which R^5 is hydrogen or alkyl, and in the case where X is $-NR^5-$, the group $-NR^4R^5-$, in the formula I may have the same meaning as the group

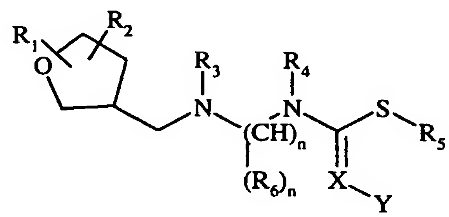
 in formula I;

Y is -N-, or $=CR^6-$, in which R^6 is hydrogen, alkyl, aryl, acyl, alkoxycarbonyl, or cyano;

Z is cyano or nitro; and,

A is ethylene or trimethylene, which may be substituted with alkyl.

Published Japanese Patent Application 08269035A discloses certain tetrahydrofuran-3-ylmethyl derivatives of the general formula I:

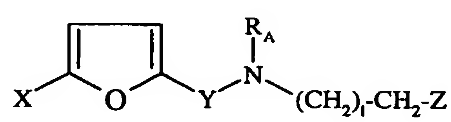


I

where

R_1 and R_2 are hydrogen, or optionally substituted C_1-C_5alkyl; R_3-R_5 are hydrogen, optionally substituted C_1-C_5alkyl, optionally substituted C_2-C_5alkenyl, or optionally substituted C_2-C_5alkynyl; n is 2-5; R_6 is hydrogen or C_1-C_3alkyl; X is CH or N; Y is NO_2 or C≡N; and R_3 and R_4 together may form a ring.

US Patent 5,075,301 claims, *inter alia*, certain furan derivatives of the following general formula that are useful for the treatment of gastro-intestinal disorders:



where

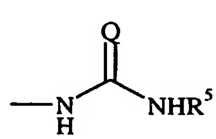
X is, among others, R^1CH_2- where R^1 is R^2R^3N-, where R^2 and R^3 are the same or different and each is hydrogen or lower alkyl;

Y is $-CH_2-$ or $-C(=O)-$;

l is an integer of 1 through 3;

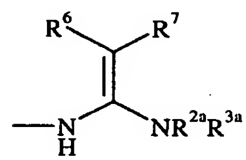
R_A is hydrogen, lower alkyl, lower alkanoyl, or substituted or un-substituted aroyl;

Z is, among others,



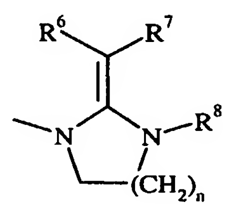
where

Q is oxygen or sulfur, R^5 is hydrogen, lower alkyl, or substituted or un-substituted aryl,



where

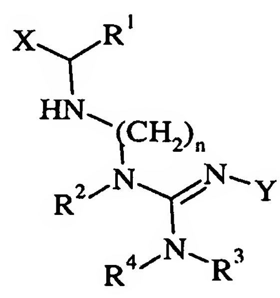
R^6 and R^7 may be the same or different and each is hydrogen, cyano, lower alkoxycarbonyl, lower alkylsulfonyl, substituted or un-substituted arylsulfonyl, or nitro; provided that R^6 and R^7 cannot concurrently be hydrogen; R^{2a} and R^{3a} have the same meaning as R^2 and R^3 described above,



where

R^6 and R^7 are as described above, R^8 is hydrogen or lower alkyl, and n is 1 or 2.

European Patent EP 0547451 B1 claims compounds of the following general formula that are useful as insecticides:



where

X represents 2-chloro-5-pyridyl or 2-chloro-5-thiazolyl;

R^1 represents hydrogen or $(C_1\text{-}C_4)$alkyl;

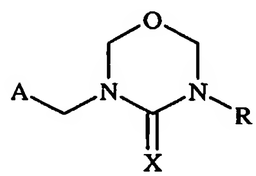
R^2 is hydrogen, $(C_1$-$C_4)$alkyl, $(C_3$-$C_4)$alkynyl, $(C_3$-$C_4)$alkenyl and 2-chloro-5-pyridyl;

R^3 and R^4 are selected from hydrogen, halogen, $(C_1$-$C_4)$alkyl, $(C_3$-$C_4)$alkynyl, $(C_3$-$C_4)$alkenyl and benzyl which may be substituted, or a group represented by X-C(R^1)H- wherein X and R^1 are the same meaning as above;

N is an integer of 2 or 3, and

Y is $-NO_2$ or –CN.

US Patent 5,852,012 claims compositions of compounds and salts thereof of the following general formula that are useful as insecticides:



where

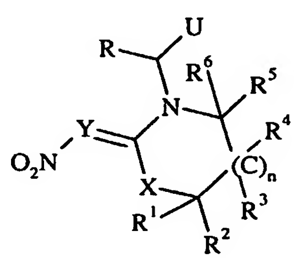
A is 2-chloropyrid-5-yl, 2-methylpyrid-5-yl, 1-oxido-3-pyridinio, 2-chloro-1-oxido-5-pyrinio, or 2-chlorothiazol-5-yl;

R is hydrogen; $(C_1$-$C_6)$alkyl, phenyl$(C_1$-$C_4)$alkyl, $(C_3$-$C_6)$cycloalkyl, $(C_2$-$C_6)$alkenyl or $(C_2$-$C_6)$alkynyl;

And

X is N-NO_2 or N-CN.

US Patent discloses compounds of the following general formula that are useful as insecticides:



where

n is 0 or 1;

R^1, R^2, R^5 and R^6 independently represent hydrogen or alkyl; R^3 and R^4 independently represent hydrogen, hydroxy or alkyl; where n is 1, then R^2 may form a single bond with R^5;

X represents -S-, -O-, =N-R^7 or =CH-R^8 wherein R^7 is, *inter alia*, hydrogen, halogen, alkyl, hydroxy, benzyl, benzyloxy, alkenylcarbonyl, benzyloxycarbonyl, mono- and dialkylaminocarbonyl, phenylaminocarbonyl, phenylsulfonylaminocarbonyl, alkylsulfonyl, and phenacyl; R^8 is hydrogen, alkyl, aryl and benzyl;

Y represents -N- or =C(-)-R^9 wherein R^9 is, *inter alia*, hydrogen, halogen, hydroxy, alkyl, alkoxy, alkylthiocarbonyl, phenoxycarbonyl, phenylthiocarbonyl, benzoylaminocarbonyl, phenylsulfonylamino, alkylthio, alkylsulfonyl and phenylthio, phenylsulfonyl;

R represents hydrogen and alkyl;

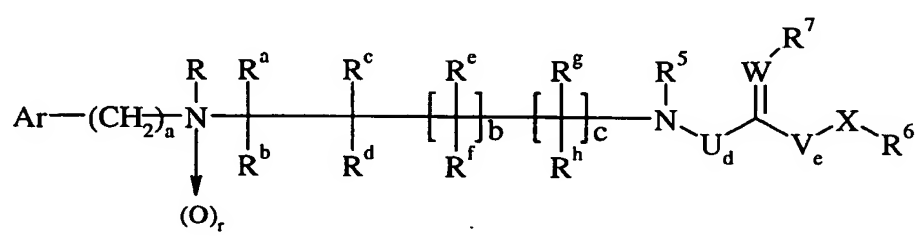
and,

U represents a 5- or 6-membered heterocyclis group containing at least one hetero atom selected from –O-, -S- and –N-; which may be substituted

There is no disclosure or suggestion in any of the above-referenced patents or patent application of the structures and insecticidal and acaricidal activity of the compounds of the present invention.

SUMMARY OF THE INVENTION

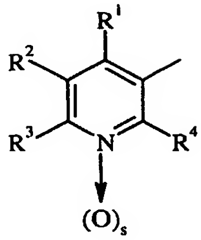
In accordance with the present invention, it has now been found that certain novel N-(heteroarylalkyl)alkanediamine derivatives are surprisingly active in the control of insects and acarids when used in the insecticidal and acaricidal compositions and methods of this invention. The compounds of formula **I** are represented by the following general formula:



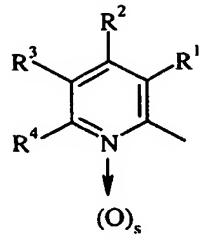
I

wherein

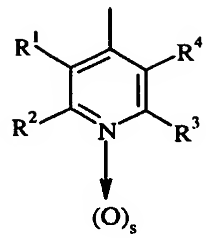
-Ar is selected from



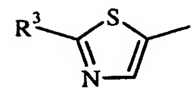
A
pyrid-3-yl,



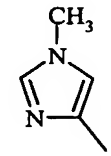
A1
pyrid-2-yl,



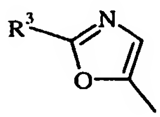
A2
pyrid-4-yl,



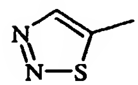
B
1,3-thiazol-5-yl,



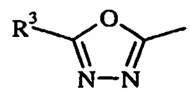
C
1-methyl-imidazol-4-yl,



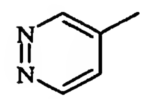
D
1,3-oxazol-5-yl,



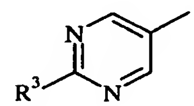
E
1,2,3-thia-diazol-5-yl,



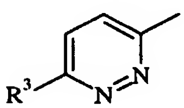
F
1,3,4-oxa-diazol-2-yl,



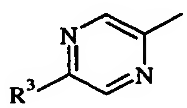
G
pyridazin-4-yl,



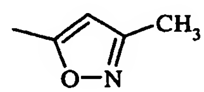
H
pyrimidin-5-yl,



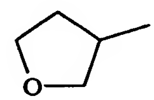
J
pyridazin-3-yl,



K
pyrazin-5-yl,



L
3-methyl-isoxazol-5-yl
and



M
oxolan-3-yl

where

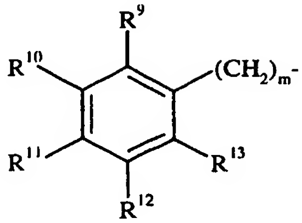
R^1, R^2, R^3, and R^4 are independently selected from hydrogen, halogen, alkyl, alkoxy, haloalkyl, and haloalkoxy;

and,

s is an integer selected from 0 or 1;

-a and r are integers independently selected from 0 or 1;

-R is selected from hydroxy, haloalkyl, alkoxyalkyl, alkoxyalkoxyalkyl, cycloalkylalkyl, cyanoalkyl, formyl, alkylcarbonyl, alkoxycarbonyl, alkylsulfonyl, dialkylphosphonato, oxolan-3-ylmethyl, 2H-3,4,5,6-tetrahydropyran-2-ylmethyl, cyclohex-1-en-3-yl, thien-3-ylmethyl, furan-2-ylmethyl, furan-3-ylmethyl, benzo[b]furan-2-ylmethyl, 2-R^8-1,3-thiazol-4-ylmethyl, 5-R^8-1,2,4-oxadiazol-3-ylmethyl,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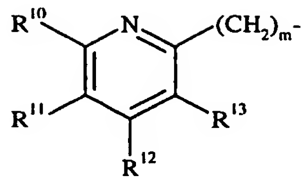
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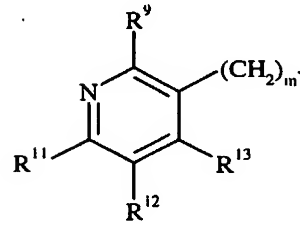
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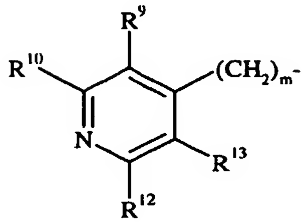

,

$-(CH_2)_m-CR^{14}{=}CR^{15}R^{16}$ and $-(CH_2)_m-C{\equiv}CR^{17}$,

where

R^8 is selected from halogen, alkyl, aryl, and heteroaryl, wherein aryl and heteroaryl are optionally substituted with at least one of halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

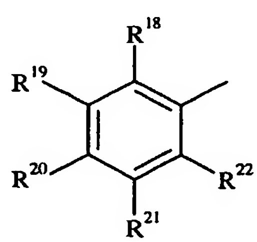
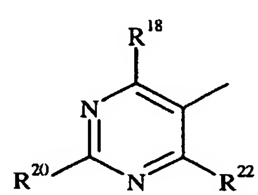
m is an integer selected from 1or 2;

and,

R^9, R^{10}, R^{11}, R^{12}, and R^{13} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, alkoxyiminoalkyl, cyano, nitro, 2-alkyl-2H-tetrazol-5-yl, aryl, and aryloxy;

R^{14}, R^{15} and R^{16} are independently selected from hydrogen, halogen, alkyl and aryl;

R^{17} is selected from hydrogen, alkyl,


, and

;

where

R^{18}, R^{19}, R^{20}, R^{21}, and R^{22} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

$-R^a$, R^b, R^c and R^d are independently selected from hydrogen and alkyl;

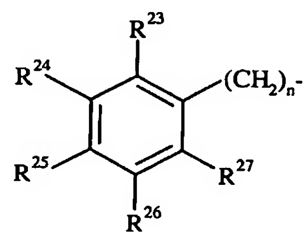
-b and c are integers independently selected from 0 or 1;

and

when b and c are 1,

-R^e, R^f, R^g and R^h are independently selected from hydrogen and alkyl;

-R^5 is selected from hydrogen, alkyl, and



,

where

n is an integer selected from 1 or 2; and,

R^{23}, R^{24}, R^{25}, R^{26}, and R^{27} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

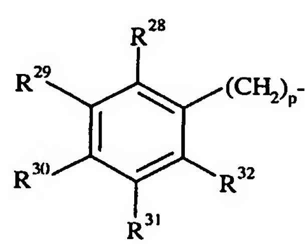
-d and e are integers independently selected from 0 and 1;

and,

when d and e are 1;

-U and V are -CH_2-;

-R^6 is selected from hydrogen, alkyl, cycloalkyl, cycloalkylalkyl, alkoxy, alkoxyalkyl, alkoxyalkoxyalkyl, alkenyl, haloalkenyl, and



,

where

p is an integer selected from 1 and 2;

and,

R^{28}, R^{29}, R^{30}, R^{31} and R^{32} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

-R^7 is selected from -C≡N and -NO_2;

-W is selected from $-CR^{33}-$ and -N-;

-X is elected from $-CR^{34}R^{35}-$, -O-, -S-, and $-NR^{36}$;

where

R^{33}, R^{34}, R^{35} and R^{36} are independently selected from hydrogen and alkyl;

provided that when

i) Ar is oxolan-3-yl (M); **ii)** a, b and c are 1, and R^a through R^g, inclusively, are hydrogen; **iii)** d, e and r are 0; **iv)** R is $-(CH_2)_mCR^{14}=CR^{15}R^{16}$ or $-(CH_2)_mC\equiv CR^{17}$; **v)** R^5 is hydrogen or alkyl; **vi)** R^6 is hydrogen, alkyl, alkenyl or haloalkenyl and **vii)** W is $-CR^{33}-$ where R^{33} is hydrogen; **viii)** then X is other than -S-;

when d and e are 0,

$-R^5$ and X may be taken together with$-CH_2(CH_2)_q-$ or $-CH_2YCH_2-$ to form a ring, where

q is an integer selected from 1 or 2;

Y is selected from O, S and NR^{37}, where R^{37} is hydrogen or alkyl;

-X is elected from -CH-, -O-, -S-, and –N-;

where

when X is -CH- or –N-,

R^6 is selected from hydrogen, alkyl and that set forth above for R;

when b and c are 0,

-R and R^5 may be taken together with $-CH_2CH_2-$ to form a piperazine ring;

and

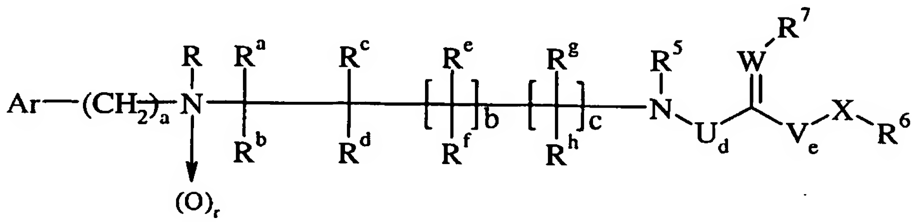
agriculturally acceptable salts thereof.

The present invention is also directed to compositions containing an insecticidally effective amount of at least one of a compound of formula **I**, and optionally, an effective amount of at least one of a second compound, with at least one insecticidally compatible carrier.

The present invention is also directed to methods of controlling insects, where control is desired, which comprise applying an insecticidally effective amount of the above composition to the locus of crops, or other areas where insects are present or are expected to be present.

DETAILED DESCRIPTION OF THE INVENTION

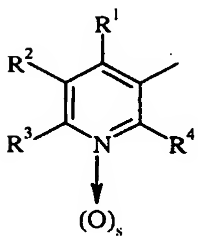
The present invention generally relates to certain new and useful compounds, namely novel N-(heteroarylalkyl)alkanediamine derivatives (hereinafter termed "compounds of formula **I**") as depicted in formula **I**:



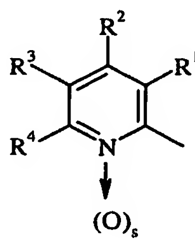
I

where

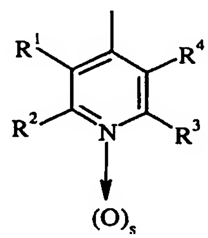
-Ar is selected from



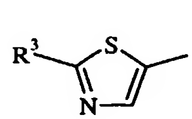
A
pyrid-3-yl,



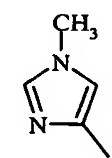
A1
pyrid-2-yl,



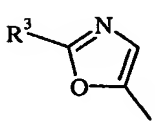
A2
pyrid-4-yl,



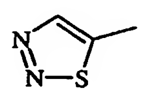
B
1,3-thiazol-5-yl,



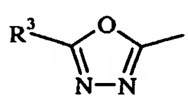
C
1-methyl-imidazol-4-yl,



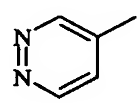
D
1,3-oxazol-5-yl,



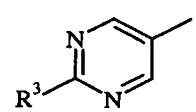
E
1,2,3-thia-diazol-5-yl,



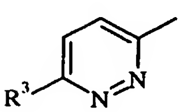
F
1,3,4-oxa-diazol-2-yl,



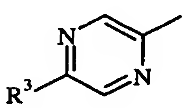
G
pyridazin-4-yl,



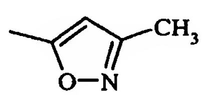
H
pyrimidin-5-yl,



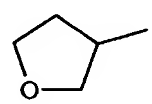
J
pyridazin-3-yl,



K
pyrazin-5-yl,



L
3-methyl-isoxazol-5-yl and



M
oxolan-3-yl

where

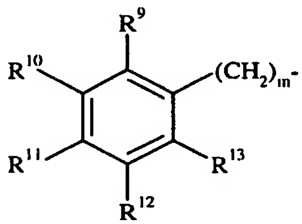
R^1, R^2, R^3, and R^4 are independently selected from hydrogen, halogen, alkyl, alkoxy, haloalkyl, and haloalkoxy;

and,

s is an integer selected from 0 or 1;

-a and r are integers independently selected from 0 or 1;

-R is selected from hydroxy, haloalkyl, alkoxyalkyl, alkoxyalkoxyalkyl, cycloalkylalkyl, cyanoalkyl, formyl, alkylcarbonyl, alkoxycarbonyl, alkylsulfonyl, dialkylphosphonato, oxolan-3-ylmethyl, 2H-3,4,5,6-tetrahydropyran-2-ylmethyl, cyclohex-1-en-3-yl, thien-3-ylmethyl, furan-2-ylmethyl, furan-3-ylmethyl, benzo[b]furan-2-ylmethyl, 2-R^8-1,3-thiazol-4-ylmethyl, 5-R^8-1,2,4-oxadiazol-3-ylmethyl,



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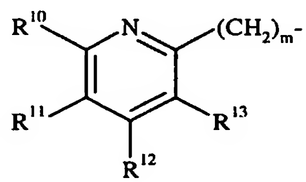

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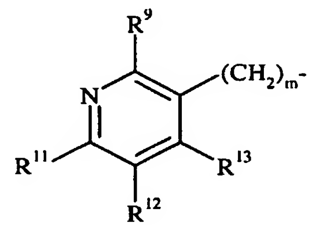
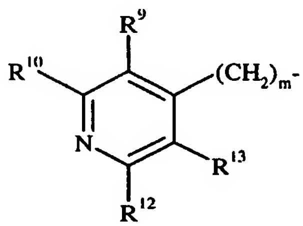


,



, -$(CH_2)_m$-CR^{14}=$CR^{15}R^{16}$ and -$(CH_2)_m$-C≡CR^{17},

where

R^8 is selected from halogen, alkyl, aryl, and heteroaryl, wherein aryl and heteroaryl are optionally substituted with at least one of halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

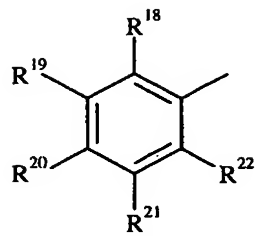
m is an integer selected from 1or 2;

and,

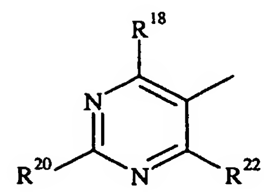
R^9, R^{10}, R^{11}, R^{12}, and R^{13} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, alkoxyiminoalkyl, cyano, nitro, 2-alkyl-2H-tetrazol-5-yl, aryl, and aryloxy;

R^{14}, R^{15} and R^{16} are independently selected from hydrogen, halogen, alkyl and aryl;

R^{17} is selected from hydrogen, alkyl,



, and



;

where

R^{18}, R^{19}, R^{20}, R^{21}, and R^{22} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

-R^a, R^b, R^c and R^d are independently selected from hydrogen and alkyl;

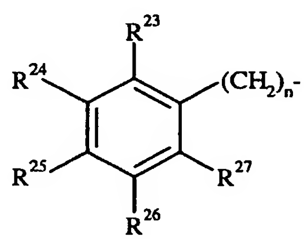
-b and c are integers independently selected from 0 or 1;

and

when b and c are 1,

-R^e, R^f, R^g and R^h are independently selected from hydrogen and alkyl;

-R^5 is selected from hydrogen, alkyl, and



,

where

n is an integer selected from 1 or 2; and,

R^{23}, R^{24}, R^{25}, R^{26}, and R^{27} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

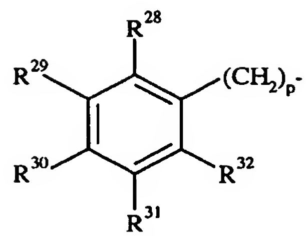
-d and e are integers independently selected from 0 and 1;

and,

when d and e are 1;

-U and V are $-CH_2-$;

-R^6 is selected from hydrogen, alkyl, cycloalkyl, cycloalkylalkyl, alkoxy, alkoxyalkyl, alkoxyalkoxyalkyl, alkenyl, haloalkenyl, and



,

where

p is an integer selected from 1 and 2;

and,

R^{28}, R^{29}, R^{30}, R^{31} and R^{32} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

$-R^7$ is selected from $-C{\equiv}N$ and $-NO_2$;

-W is selected from $-CR^{33}-$ and -N-;

-X is elected from $-CR^{34}R^{35}-$, -O-, -S-, and $-NR^{36}$;

where

R^{33}, R^{34}, R^{35} and R^{36} are independently selected from hydrogen and alkyl;

provided that when

i) Ar is oxolan-3-yl (M); **ii)** a, b and c are 1, and R^a through R^g, inclusively, are hydrogen; **iii)** d, e and r are 0; **iv)** R is $-(CH_2)_mCR^{14}{=}CR^{15}R^{16}$ or $-(CH_2)_mC{\equiv}CR^{17}$; **v)** R^5 is hydrogen or alkyl; **vi)** R^6 is hydrogen, alkyl, alkenyl or haloalkenyl and **vii)** W is $-CR^{33}-$ where R^{33} is hydrogen; **viii)** then X is other than -S-;

when d and e are 0,

$-R^5$ and X may be taken together with$-CH_2(CH_2)_q-$ or $-CH_2YCH_2-$ to form a ring, where

q is an integer selected from 1 or 2;

Y is selected from O, S and NR^{37}, where R^{37} is hydrogen or alkyl;

-X is elected from -CH-, -O-, -S-, and –N-;

where

when X is -CH- or –N-,

R^6 is selected from hydrogen, alkyl and that set forth above for R;

when b and c are 0,

-R and R^5 may be taken together with $-CH_2CH_2-$ to form a piperazine ring;

and

agriculturally acceptable salts thereof.

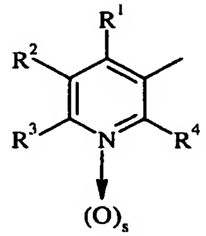
Preferred species are those compounds of formula **I** where a is 1; b, c, d and e are each 0; R^a, R^b, R^c and R^d are each hydrogen; R^5 is selected from hydrogen and alkyl; W is selected from -CR^{33}- and -N-, where R^{33} is hydrogen; X is selected from -O-, -S-, and -NR^{36}-;

and

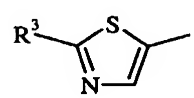
R^5 and X may be taken together with–$CH_2(CH_2)_q$- or –CH_2YCH_2- to form a ring, where

Y is selected from -O- and -NR^{37}-, where R^{37} is hydrogen or alkyl; X is –N- and R^6 is selected from hydrogen and alkyl.

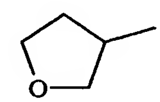
More preferred species are those compounds of formula **I** where Ar is selected from



A
pyrid-3-yl,



B
1,3-thiazol-5-yl and

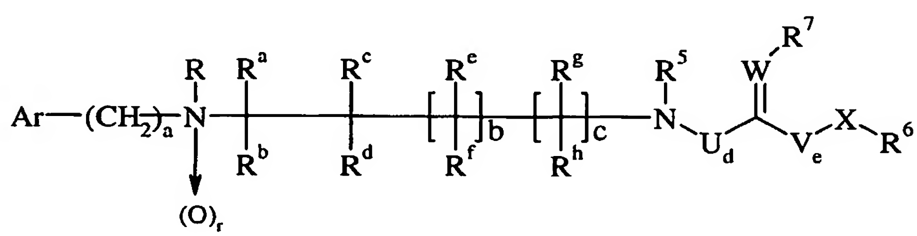


M
oxolan-3-yl

where

s is 0; R^1, R^2 and R^4 are each hydrogen and R^3 is halogen.

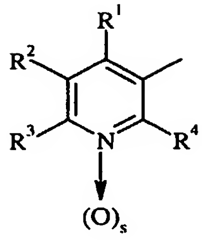
More specifically, in one aspect of the present invention certain new and useful N-(heteroarylalkyl)alkanediamine derivatives as depicted in formula **I** are providing unexpected control of insects and acarids:



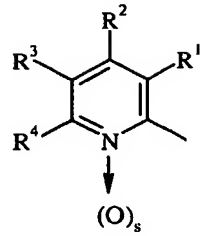
I

where

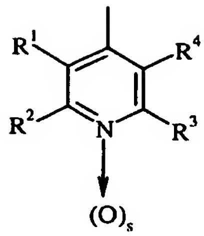
-Ar is selected from



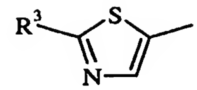
A
pyrid-3-yl,



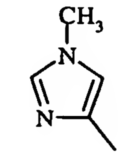
A1
pyrid-2-yl,



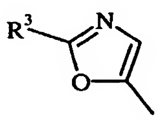
A2
pyrid-4-yl,



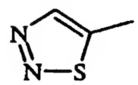
B
1,3-thiazol-5-yl,



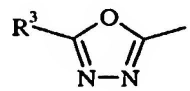
C
1-methyl-imidazol-4-yl,



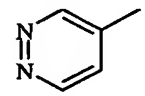
D
1,3-oxazol-5-yl,



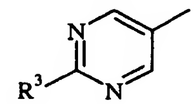
E
1,2,3-thia-diazol-5-yl,



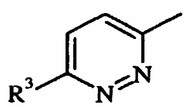
F
1,3,4-oxa-diazol-2-yl,



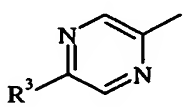
G
pyridazin-4-yl,



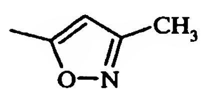
H
pyrimidin-5-yl,



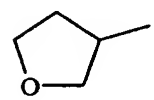
J
pyridazin-3-yl,



K
pyrazin-5-yl,



L
3-methyl-isoxazol-5-yl
and



M
oxolan-3-yl

where

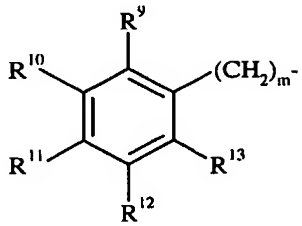
R^1, R^2, R^3, and R^4 are independently selected from hydrogen, halogen, alkyl, alkoxy, haloalkyl, and haloalkoxy;

and,

s is an integer selected from 0 or 1;

-a and r are integers independently selected from 0 or 1;

-R is selected from hydroxy, haloalkyl, alkoxyalkyl, alkoxyalkoxyalkyl, cycloalkylalkyl, cyanoalkyl, formyl, alkylcarbonyl, alkoxycarbonyl, alkylsulfonyl, dialkylphosphonato, oxolan-3-ylmethyl, 2H-3,4,5,6-tetrahydropyran-2-ylmethyl, cyclohex-1-en-3-yl, thien-3-ylmethyl, furan-2-ylmethyl, furan-3-ylmethyl, benzo[b]furan-2-ylmethyl, 2-R^8-1,3-thiazol-4-ylmethyl, 5-R^8-1,2,4-oxadiazol-3-ylmethyl,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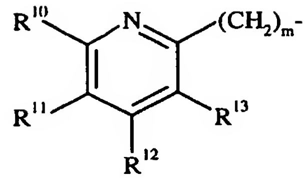
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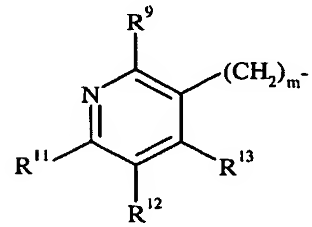
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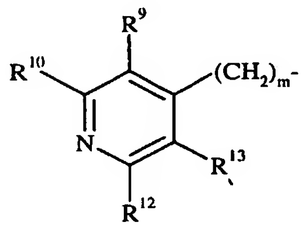

,
$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$ and $-(CH_2)_m-C\equiv CR^{17}$,

where

R^8 is selected from halogen, alkyl, aryl, and heteroaryl, wherein aryl and heteroaryl are optionally substituted with at least one of halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

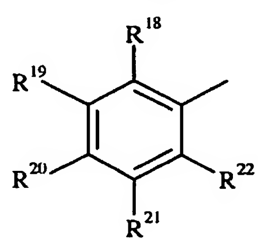
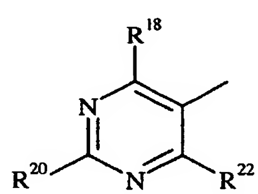
m is an integer selected from 1or 2;

and,

R^9, R^{10}, R^{11}, R^{12}, and R^{13} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, alkoxyiminoalkyl, cyano, nitro, 2-alkyl-2H-tetrazol-5-yl, aryl, and aryloxy;

R^{14}, R^{15} and R^{16} are independently selected from hydrogen, halogen, alkyl and aryl;

R^{17} is selected from hydrogen, alkyl,


, and

;

where

R^{18}, R^{19}, R^{20}, R^{21}, and R^{22} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

$-R^a$, R^b, R^c and R^d are independently selected from hydrogen and alkyl;

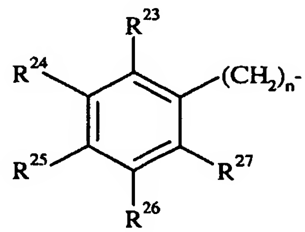
-b and c are integers independently selected from 0 or 1;

and

when b and c are 1,

-R^e, R^f, R^g and R^h are independently selected from hydrogen and alkyl;

-R^5 is selected from hydrogen, alkyl, and



,

where

n is an integer selected from 1 or 2; and,

R^{23}, R^{24}, R^{25}, R^{26}, and R^{27} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

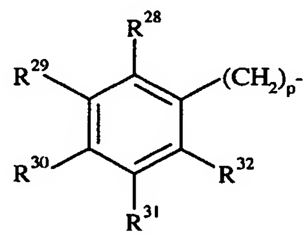
-d and e are integers independently selected from 0 and 1;

and,

when d and e are 1;

-U and V are $-CH_2-$;

-R^6 is selected from hydrogen, alkyl, cycloalkyl, cycloalkylalkyl, alkoxy, alkoxyalkyl, alkoxyalkoxyalkyl, alkenyl, haloalkenyl, and



,

where

p is an integer selected from 1 and 2;

and,

R^{28}, R^{29}, R^{30}, R^{31} and R^{32} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

-R^7 is selected from $-C{\equiv}N$ and $-NO_2$;

-W is selected from -CR^{33}- and -N-;

-X is elected from -CR^{34}R^{35}-, -O-, -S-, and -NR^{36}-;

where

R^{33}, R^{34}, R^{35} and R^{36} are independently selected from hydrogen and alkyl;

provided that when

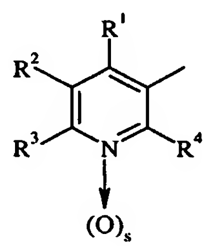
i) Ar is oxolan-3-yl (M); **ii)** a, b and c are 1, and R^a through R^g, inclusively, are hydrogen; **iii)** d, e and r are 0; **iv)** R is $-(CH_2)_mCR^{14}{=}CR^{15}R^{16}$ or $-(CH_2)_mC{\equiv}CR^{17}$; **v)** R^5 is hydrogen or alkyl; **vi)** R^6 is hydrogen, alkyl, alkenyl or haloalkenyl and **vii)** W is -CR^{33}- where R^{33} is hydrogen; **viii)** then X is other than -S-;

and

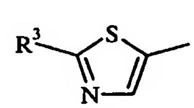
agriculturally acceptable salts thereof.

Preferred species in this aspect of the present invention are those compounds of formula **I** where a is 1; b, c, d and e are each 0; R^a, R^b, R^c and R^d are each hydrogen; R^5 is selected from hydrogen and alkyl; W is selected from -CR^{33}- and -N-, where R^{33} is hydrogen and X is selected from -O-, -S-, and -NR^{36}-.

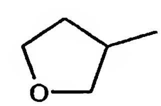
More preferred species in this aspect of the present invention are those compounds of formula **I** where Ar is selected from



A
pyrid-3-yl,



B
1,3-thiazol-5-yl and

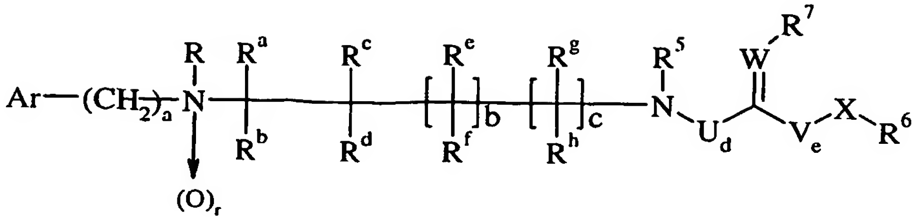


M
oxolan-3-yl

where

s is 0; R^1, R^2 and R^4 are each hydrogen and R^3 is halogen.

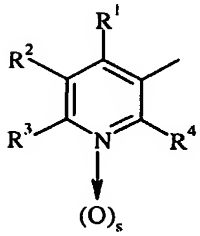
More specifically, in another aspect of the present invention certain new and useful N-(heteroarylalkyl)alkanediamine derivatives as depicted in formula **I** are providing unexpected control of insects and acarids:



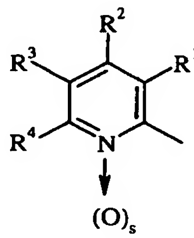
I

where

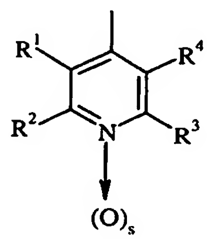
-Ar is selected from



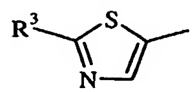
A pyrid-3-yl,



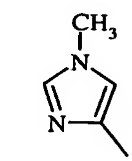
A1 pyrid-2-yl,



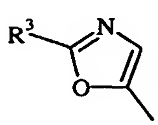
A2 pyrid-4-yl,



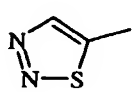
B 1,3-thiazol-5-yl,



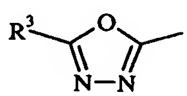
C 1-methyl-imidazol-4-yl,



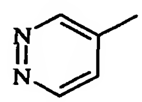
D 1,3-oxazol-5-yl,



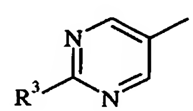
E 1,2,3-thiadiazol-5-yl,



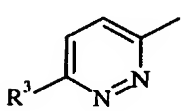
F 1,3,4-oxadiazol-2-yl,



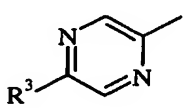
G pyridazin-4-yl,



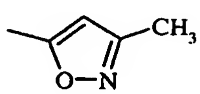
H pyrimidin-5-yl,



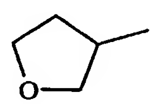
J pyridazin-3-yl,



K pyrazin-5-yl,



L 3-methyl-isoxazol-5-yl and



M oxolan-3-yl

where

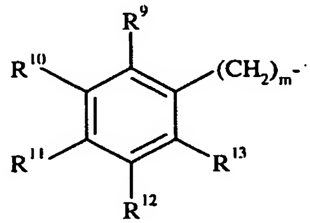
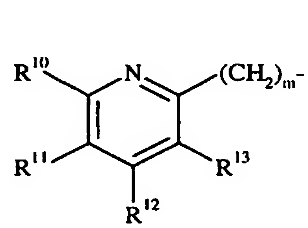
R^1, R^2, R^3, and R^4 are independently selected from hydrogen, halogen, alkyl, alkoxy, haloalkyl, and haloalkoxy;

and,

s is an integer selected from 0 or 1;

-a and r are integers independently selected from 0 or 1;

-R is selected from hydrogen, hydroxy, alkyl, haloalkyl, alkoxyalkyl, alkoxyalkoxyalkyl, cycloalkylalkyl, cyanoalkyl, formyl, alkylcarbonyl, alkoxycarbonyl, alkylsulfonyl, dialkylphosphonato, oxolan-3-ylmethyl, 2H-3,4,5,6-tetrahydropyran-2-ylmethyl, cyclohex-1-en-3-yl, thien-3-ylmethyl, furan-2-ylmethyl, furan-3-ylmethyl, benzo[b]furan-2-ylmethyl, 2-R^8-1,3-thiazol-4-ylmethyl, 5-R^8-1,2,4-oxadiazol-3-ylmethyl,


,

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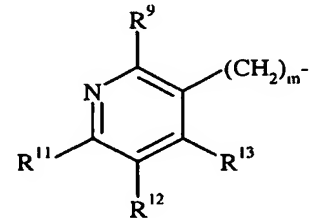
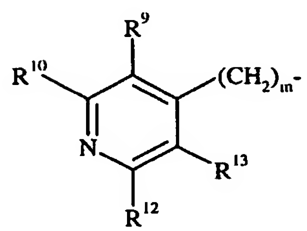

,


,
$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$ and $-(CH_2)_m-C\equiv CR^{17}$,

where

R^8 is selected from halogen, alkyl, aryl, and heteroaryl, wherein aryl and heteroaryl are optionally substituted with at least one of halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

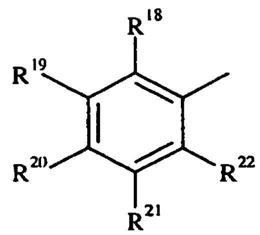
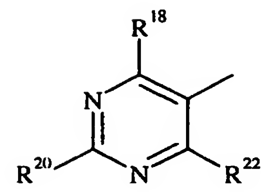
m is an integer selected from 1or 2;

and,

R^9, R^{10}, R^{11}, R^{12}, and R^{13} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, alkoxyiminoalkyl, cyano, nitro, 2-alkyl-2H-tetrazol-5-yl, aryl, and aryloxy;

R^{14}, R^{15} and R^{16} are independently selected from hydrogen, halogen, alkyl and aryl;

R^{17} is selected from hydrogen, alkyl,

 , and  ;

where

R^{18}, R^{19}, R^{20}, R^{21}, and R^{22} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

-R^a, R^b, R^c and R^d are independently selected from hydrogen and alkyl;

-b and c are integers independently selected from 0 or 1;

and

when b and c are 1,

-R^e, R^f, R^g and R^h are independently selected from hydrogen and alkyl;

-d and e are 0;

-R^5 and X are taken together with–$CH_2(CH_2)_q$- or –CH_2YCH_2- to form a ring,

where

q is an integer selected from 1 or 2;

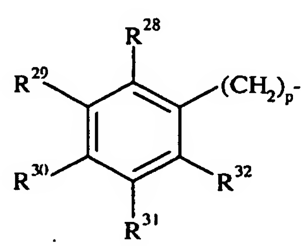
Y is selected from -O-, -S- and -NR^{37}-, where R^{37} is hydrogen or alkyl;

-X is elected from -CH-, -O-, -S-, and –N-;

where

when X is -CH- or -N-,

-R^6 is selected from hydrogen, alkyl, cycloalkyl, cycloalkylalkyl, alkoxy, alkoxyalkyl, alkoxyalkoxyalkyl, alkenyl, haloalkenyl, and

 ,

where

p is an integer selected from 1 and 2;

and,

R^{28}, R^{29}, R^{30}, R^{31} and R^{32} are independently selected from hydrogen, halogen, alkyl, haloalkyl, alkoxy, and haloalkoxy;

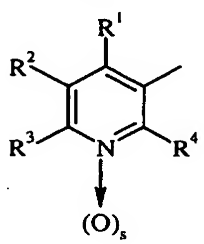
-R^7 is selected from -C≡N and -NO_2;

-W is selected from –CR^{33}- and -N-, where R^{33} is selected from hydrogen and alkyl; and

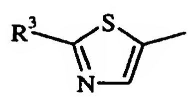
agriculturally acceptable salts thereof.

Preferred species in this aspect of the present invention are those compounds of formula **I** where a is 1; b, c, d and e are each 0; R^a, R^b, R^c and R^d are each hydrogen; W is selected from -CR^{33}- and -N-, where R^{33} is hydrogen; Y is selected from -O- and NR^{37}; X is –N- and R^6 is selected from hydrogen and alkyl.

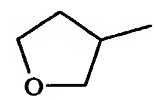
More preferred species in this aspect of the present invention are those compounds of formula **I** where Ar is selected from



A
pyrid-3-yl,



B
1,3-thiazol-5-yl and



M
oxolan-3-yl

where

s is 0; R^1, R^2 and R^4 are each hydrogen and R^3 is halogen.

In addition, in certain cases the compounds of the present invention may possess asymmetric centers, which can give rise to optical enantiomorphs and diastereomers. The compounds may exist in two or more forms, i.e., polymorphs, which are significantly different in physical and chemical properties. The compounds of the present invention may also exist as tautomers, in which migration of a hydrogen atom within the molecule results in two or more structures, which are in equilibrium. The compounds of the present invention may also possess acidic or basic moieties, which may allow for the formation of agriculturally acceptable salts or agriculturally acceptable metal complexes.

This invention includes the use of such enantiomorphs, polymorphs, tautomers, salts and metal complexes. Agriculturally acceptable salts and metal

complexes include, without limitation, for example, ammonium salts, the salts of organic and inorganic acids, such as hydrochloric acid, sulfonic acid, ethanesulfonic acid, trifluoroacetic acid, methylbenzenesulfonic acid, phosphoric acid, gluconic acid, pamoic acid, and other acid salts, and the alkali metal and alkaline earth metal complexes with, for example, sodium, potassium, lithium, magnesium, calcium, and other metals.

The methods of the present invention are predicated on causing an insecticidally effective amount of a compound of formula **I** to be present within insects in order to kill or control the insects. Preferred insecticidally effective amounts are those that are sufficient to kill the insect. It is within the scope of the present invention to cause a compound of formula **I** to be present within insects by contacting the insects with a derivative of that compound, which derivative is converted within the insect to a compound of formula **I**. This invention includes the use of such compounds, which can be referred to as pro-insecticides.

Another aspect of the present invention relates to compositions containing an insecticidally effective amount of at least one compound of formula **I** with at least one insecticidally compatible carrier therefor.

Another aspect of the present invention relates to compositions containing an insecticidally effective amount of at least one compound of formula **I**, and an effective amount of at least one second compound, with at least one insecticidally compatible carrier therefor.

Another aspect of the present invention relates to methods of controlling insects by applying an insecticidally effective amount of a composition set forth above to a locus of crops such as, without limitation, cereals, cotton, vegetables, and fruits, or other areas where insects are present or are expected to be present.

The present invention also includes the use of the compounds and compositions set forth herein for control of non-agricultural insect species, for example, dry wood termites and subterranean termites; as well as for use as pharmaceutical agents and compositions thereof. In the field of veterinary medicine, the compounds of the present invention are expected to be effective against certain *endo-* and *ecto*-parasites, such as insects and worms, which prey on animals. Examples of such animal parasites include, without limitation, *Gastrophilus* spp.,

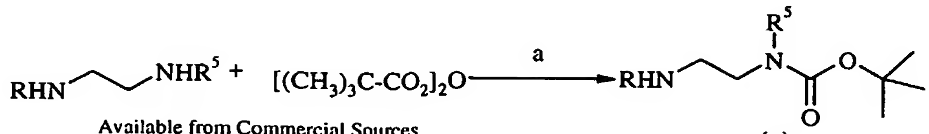
Stomoxys spp., *Trichodectes* spp., *Rhodnius* spp., Ctenocephalides canis, and other species.

As used in this specification and unless otherwise indicated the substituent terms "alkyl" and "alkoxy", used alone or as part of a larger moiety, includes straight or branched chains of at least one or two carbon atoms, as appropriate to the substituent, and preferably up to 12 carbon atoms, more preferably up to ten carbon atoms, most preferably up to seven carbon atoms. The term "alkenyl" and "alkynyl" used alone or as part of a larger moiety, includes straight or branched chains of at least two carbon atoms containing at least one carbon-carbon double bond or triple bond, and preferably up to 12 carbon atoms, more preferably up to ten carbon atoms, most preferably up to seven carbon atoms. The term "aryl" refers to an aromatic ring structure, including fused rings, having four to ten carbon atoms, for example, phenyl or naphthyl. The term "heteroaryl" refers to an aromatic ring structure, including fused rings, in which at least one of the atoms is other than carbon, for example, without limitation, sulfur, oxygen, or nitrogen. The term "GC analysis" refers to gas chromatographic analysis of, for example, a chemical reaction mixture. The term "DMF" refers to N,N-dimethylformamide. The term "THF" refers to tetrahydrofuran. The term "halogen" or "halo" refers to fluorine, bromine, iodine, or chlorine. The term "ambient temperature" or "room temperature" often abbreviated as "RT", for example, in reference to a chemical reaction mixture temperature, refers to a temperature in the range of 20 °C to 30 °C. The term "insecticidal" or "acaricidal", "insecticide" or "acaricide" refers to a compound of the present invention, either alone or in admixture with at least one of a second compound, or with at least one compatible carrier, which causes the destruction or the inhibition of action of insects or acarids.

The novel compounds of formula **I** can be synthesized by methods that are individually known to one skilled in the art from intermediate compounds readily available in commerce.

Scheme 1 below illustrates a general procedure for synthesizing N-(heteroarylalkyl)alkanediamine derivatives of formula **I**, *inter alia*, where, for example Ar is pyrid-3-yl (A, where s is 0) substituted with R^1 through R^4, inclusively, a is 1; R^a through R^d, inclusively, are hydrogen; b through e, inclusively, and r are 0; W is CR^{33} where R^{33} is hydrogen; and R^7 is $-NO_2$:

Scheme 1

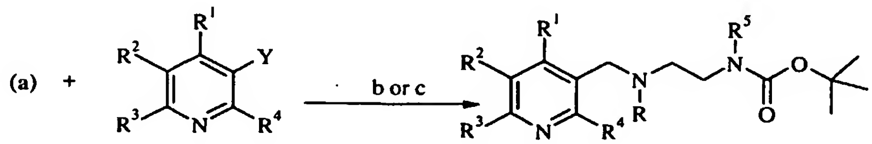


Available from Commercial Sources where R and R^5 are hydrogen

(a)

A Known Compound

a) THF / 0 °C to RT

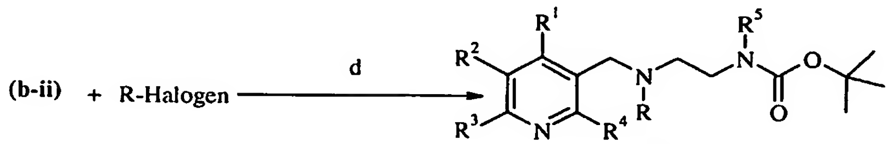


(b-ii)

(**Ar-Y**, where Y is $-CH_2Cl$ or -CHO are known compounds where R^1, R^2, R^4 are hydrogen, and R^3 is chloro)

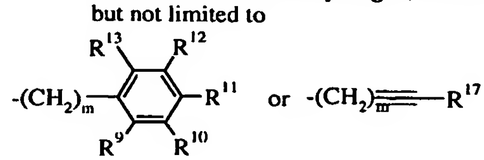
Note: Using reaction conditions (b) results in a mixture of di-alkylated material designated **i)** and a mono-alkylated material designated **ii)** in Example 1. In Example 2, reaction conditions (c) result in formation of the mono-alkylated material designated **ii)**

b) where Y is $-CH_2Cl$: Et_3N / CH_3CN; c) where Y is –CHO: 1) Et_3N / $MgSO_4$ / CH_3OH / RT; 2) $NaBH_4$ / 0°C to RT

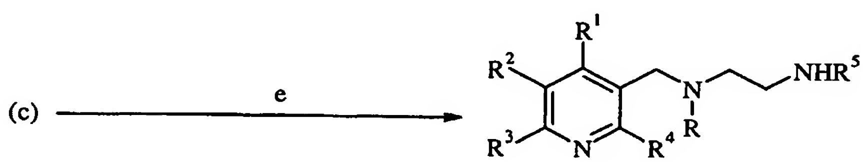


(c)

where R is other than hydrogen, for example, but not limited to



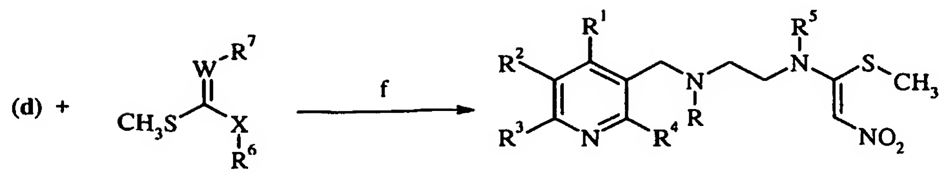
d) a base such as diisopropylamine or diethanolamine / CH_3CN / Δ



(d)

Where R^5 is hydrogen

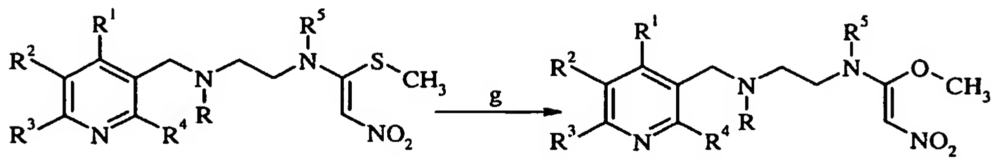
e) CF_3COOH / 0 °C to RT



Commercially Available where W is CR^{33}, where R^{33} is hydrogen, X is S, R^6 is methyl, and R^7 is nitro.

Compounds of Formula I

f) dimethylaminopyridine / CH_3CN / Δ



Compounds of Formula I

Additional Compounds of Formula I

g) $NaOCH_3$ / CH_3OH / RT

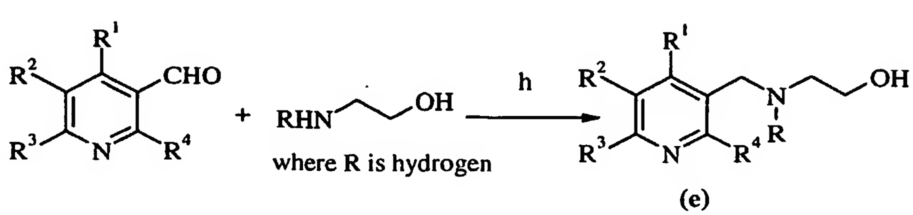
As depicted in Scheme 1, an appropriate diamine, for example the commercially available ethylenediamine, was treated with di-*tert*-butyl dicarbonate as a means of protecting one of the amino groups from unwanted reactions, yielding the corresponding (*tert.*-butoxy)carboxamide, which is a known compound. The (*tert*-butoxy)carboxamide was in turn reacted with 1) either an appropriate aryl halide such as the known compound (6-chloropyrid-3-yl)methyl chloride or 2) an appropriate (aryl)formaldehyde such as the known compound (6-chloro-3-pyridyl)formaldehyde. The former reaction 1) was conducted under basic conditions in an appropriate solvent and resulted in the formation of a mixture of products, for example a di-alkylated material, namely, **i)** N-(2-[bis[6-chloro(3-pyridyl)methyl]amino]ethyl)(*tert*-butoxy)carboxamide, and a mono-alkylated material, namely, **ii)** (*tert*-butoxy)-N-(2-{[(6-chloro(3-pyridyl))methyl]amino}ethyl)carboxamide. The so-formed mixture of **i)** and **ii)** was easily separated into its individual components with column chromatography, thereby providing two useful intermediates finding utility in preparing compounds of formula **I**. In the more preferred latter reaction 2), the formaldehyde was condensed under basic conditions with the (*tert*-butoxy)carboxamide in the presence of a drying agent, providing the corresponding imine, which was not isolated. The so-formed imine was in turn reduced with, for example, sodium borohydride,

yielding the corresponding intermediate **ii)** set forth above. Intermediate **(b-ii)**, where R is hydrogen, was then reacted under basic conditions with an appropriate halogen derivative, such as (4-methoxyphenyl)methyl chloride, or propargyl bromide, yielding the corresponding intermediates **(c)**, wherein the moiety R is now, for example, (4-methoxyphenyl)methyl or propargyl. Intermediate **(c)** was then treated with an acid, such as trifluoroacetic acid, to remove the amine-protecting (*tert*-butoxy)carboxamide group, affording intermediate **(d)**, for example, (2-aminoethyl)[(6-chloro(3-pyridyl)methyl][(4-methoxyphenyl)methyl]amine and (2-aminoethyl)[(6-chloro(3-pyridyl)methyl]prop-2-ynylamine. The free amine, intermediate **(d)** was converted to compounds of formula **I** by the reaction of it, in the presence of a catalyst, with an appropriate alkylthio derivative, for example, the commercially available 1,1-bis(methylthio)-2-nitroethylene, thereby introducing the moiety $-C(XR^6)=WR^7$ into the molecule wherein X is S, R^6 is $-CH_3$, W is $-CR^{33}$- where R^{33} is hydrogen, and R^7 is $-NO_2$.

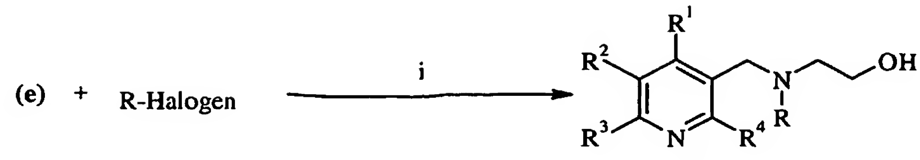
Compounds of formula **I** may be converted to other compounds of formula **I**. For example, compounds wherein X is S and R^6 is $-CH_3$ may be treated with sodium methylate in methanol, affording those compounds of formula **I** where X is O and R^6 is $-CH_3$. Examples 1 and 2 set forth below provide in detail certain methods by which compounds of formula **I** depicted in Scheme 1 were prepared.

Scheme 2 below illustrates a general procedure for synthesizing N-(heteroarylalkyl)alkanediamine derivatives of formula **I**, *inter alia*, where, for example Ar is pyrid-3-yl (A, where s is 0) substituted with R^1 through R^4, inclusively; a is 1; R^a through R^d, inclusively, are hydrogen; b through e, inclusively, and r are 0; R^5 and X are taken together with $-CH_2(CH_2)_q-$ to form a ring wherein X and W are N, R^6 is hydrogen, and R^7 is $-NO_2$

<u>Scheme 2</u>



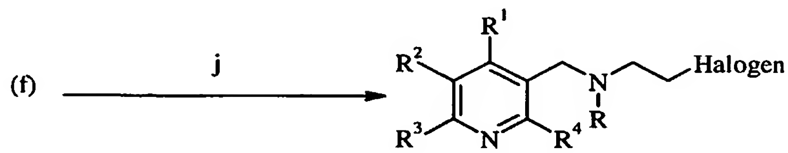
h) 1) Et_3N / $MgSO_4$ / CH_3OH / RT; 2) $NaBH_4$ / 0 °C to RT



(f)

where R is other than hydrogen, for example, but not limited to n-C_3H_7

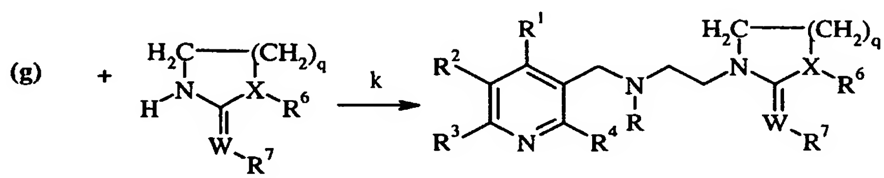
i) Et_3N / CH_3CN / Δ



(g)

where halogen is, for example, chlorine or bromine

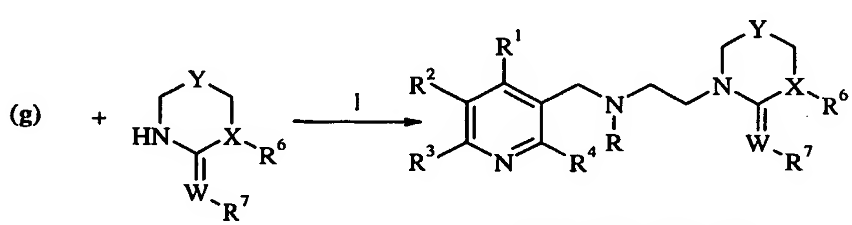
j) $SOCl_2$ / $CHCl_3$ / 0 °C to RT or CBr_4 / Ph_3P / CH_2Cl_2



Compounds of formula **I**

where, for example, X and W are N, R^6 is hydrogen, q is 1, and R^7 is -NO_2

k) 60% NaH / DMF / 0 °C to 70 °C



Compound 17b prepared by Maienfisch et al Pest Manage. Sci. 165-176 (2001)

Compounds of formula **I**

where, for example, X and W are N, Y is oxygen, R^6 is -CH_3, and R^7 is -NO_2

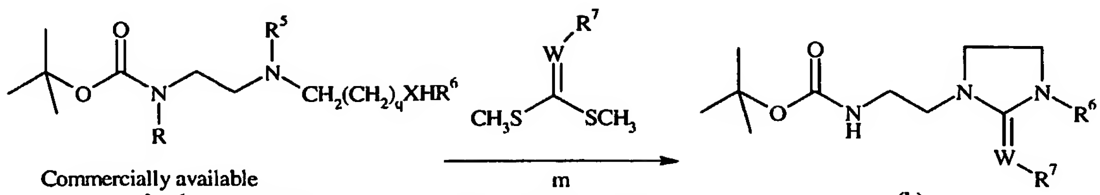
l) K_2CO_3 / DMF / 70 °C-RT

As depicted in Scheme 2, an appropriate (aryl)formaldehyde such as the known compound (6-chloro-3-pyridyl)formaldehyde, was condensed with an aminoalkanol, such as 2-aminoethan-1-ol, then reduced with a reducing agent, such as sodium borohydride as set forth above, providing the corresponding alcohol intermediate **(e)**, for example, 2-{[(6-chloro-3-pyridyl)methyl]amino}ethan-1-ol. Intermediate **(e)**, where R is hydrogen, was then reacted under basic conditions with an appropriate halogen derivative, such as 1-iodopropane, yielding the corresponding intermediate **(f)**, wherein the moiety R is now, for example, n-propyl. Intermediate **(f)** was in turn treated with, for example thionyl chloride, thereby converting intermediate **(f)** to the corresponding halogen intermediate **(g)**, for example, [(6-chloro(3-pyridyl))methyl](2-chloroethyl)propylamine. The so-prepared intermediate **(g)** was converted to compounds of formula **I** by the reaction of it with, for example, the sodium salt of the commercially available 2-(nitromethylene)imidazolidine, thereby introducing a ring into the molecule wherein R^5 and X are taken together with $-CH_2(CH_2)_q-$, X and W are N, R^6 is hydrogen, and R^7 is $-NO_2$. Example 3 set forth below provides in detail one method by which compounds of formula **I** depicted in Scheme 2 are prepared.

Intermediate **(g)** was converted to additional compounds of formula **I** by the reaction of it with, for example, 4-(azanitromethylene)-3-methyl-1,3,5-oxadiazaperhydroine (prepared by the method of P. Maienfisch et al; Pest Management Science 165-176 (2001), under basic conditions, thereby introducing a different ring into the molecule wherein R^5 and X are taken together with $-CH_2YCH_2-$, where Y is, for example, O, X and W are N, R^6 is $-CH_3$, and R^7 is $-NO_2$. Example 4 set forth below provides in detail another method by which compounds of formula **I** depicted in Scheme 2 were prepared.

Scheme 3 below illustrates another general procedure for synthesizing N-(heteroarylalkyl)alkanediamine derivatives of formula **I**, *inter alia*, where, for example Ar is pyrid-3-yl (A, where s is 0) substituted with R^1 through R^4, inclusively; a is 1; R^a through R^d, inclusively, are hydrogen; b through e, inclusively, and r are 0; R^5 and X are taken together with $-CH_2(CH_2)_q-$ to form a ring wherein X is N, W is CR^{33} where R^{33} is hydrogen, R^6 is hydrogen, and R^7 is $-NO_2$:

<u>Scheme 3</u>



Commercially available where R, R^5, R^6 are hydrogen; X is N, q is 1

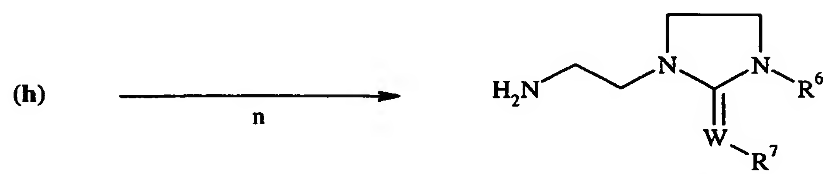
Commercially available where W is CR^{33} and R^{33} is hydrogen and R^7 is nitro.

where W is N and R^7 is nitro is prepared in US patent 5,453,529, now expired.

(h)

where R^5 and X are taken together with $-CH_2(CH_2)_q-$ to form a ring

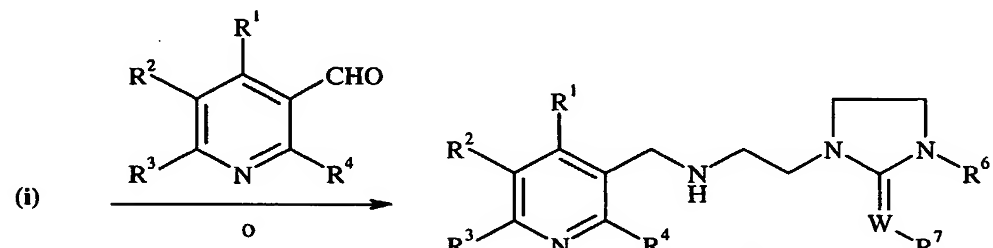
m) Et_3N / CH_3CN / Reflux



(i)

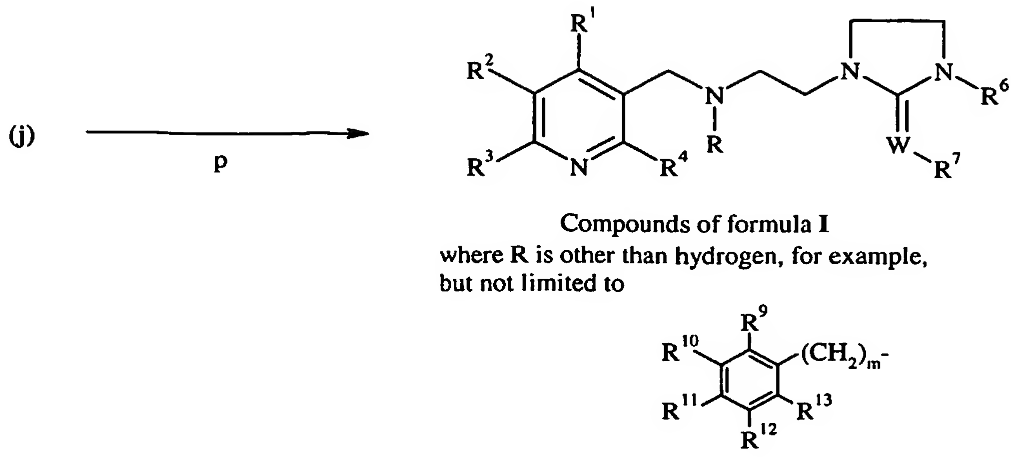
Complex with trifluoroacetic acid

n) HOAc / CH_2Cl_2 / 0 °C-RT



(j)

o) 1-CH_3OH / RT; 2-$NaCNBH_3$; 3-HOAc / -5 °C-RT

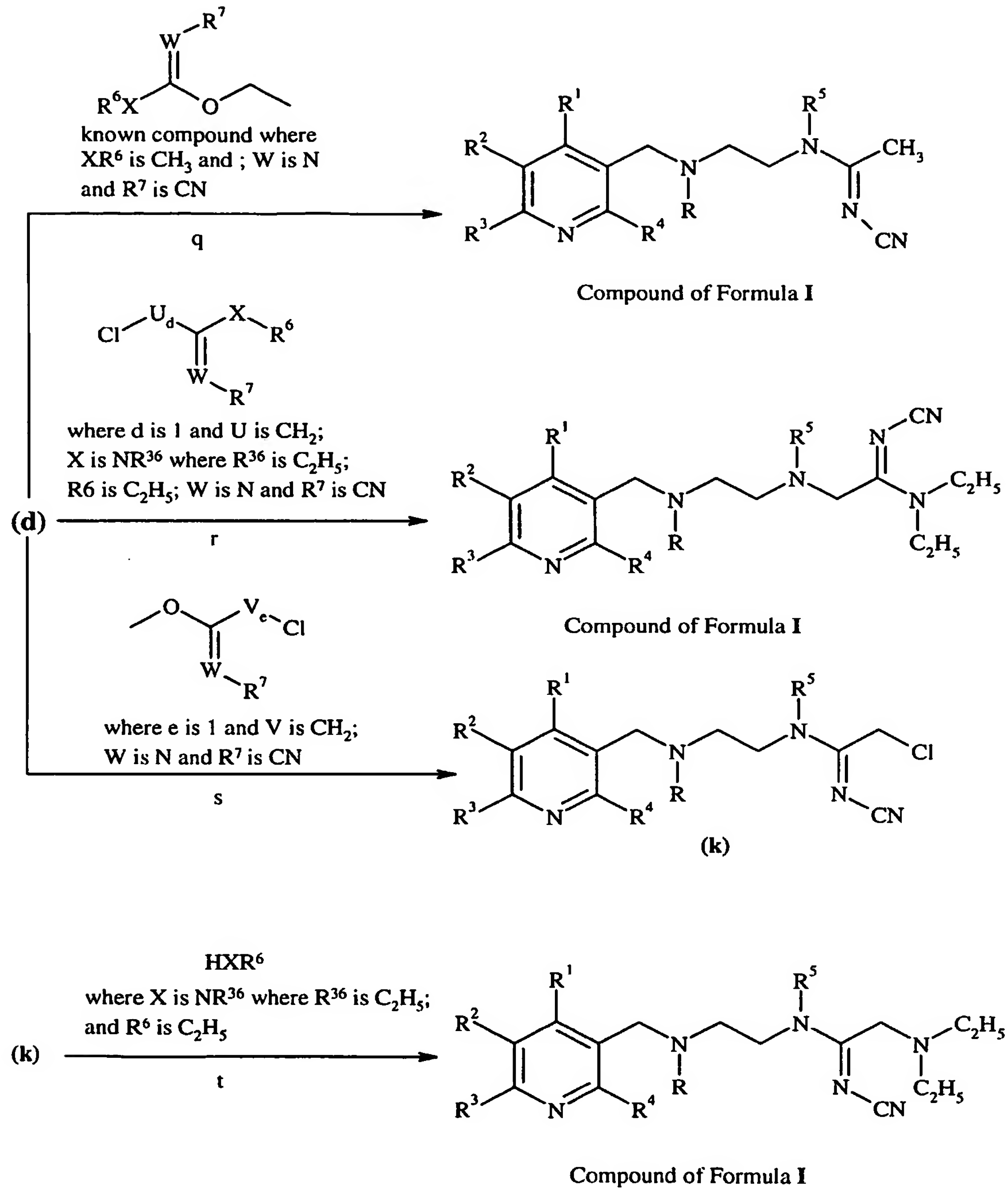


p) a base such as diisopropylamine or diethanolamine / CH_3CN / RT-45 °C or $NaBH(OAc)_3$ / $MgSO_4$ / $ClCH_2CH_2Cl$

As depicted in Scheme 3, an appropriately protected diamine, for example the commercially available N-{2-[(2-aminoethyl)amino]ethyl}(*tert*-butoxy)carboxamide was cyclized under basic conditions with a known or commercially available (dialkylthio)ethene compound, for example 1,1-di(methylthio)-2-nitroethene, yielding the corresponding cyclic derivative **(h)**, such as (*tert*-butoxy)-N-{2-[2-(nitromethlene)imidazolidinyl]ethyl}carboxamide. Intermediate **(h)** was in turn deprotected under acidic conditions, affording the free amine **(i)**, as a salt, for example 2-[2-(nitromethylene)imidazolidinyl]ethylamine, acetic acid salt. The moiety Ar was then introduced into the molecule by reacting the salt **(i)** with, for example (6-chloro-3-pyridyl)formaldehyde, providing the corresponding substituted amine intermediate **(j)**, such as [(6-chloro(3-pyridyl))methyl]{2-[2-(nitromethylene)imidazolidinyl]ethyl]amine. Intermediate **(j)** was then converted to a compound of formula **I**, by the reaction of **(j)** with, for example 2-chlorobenzaldehyde, under basic conditions that introduced moiety R into the molecule. Example 5 set forth below provides in detail the method by which compounds of formula **I** depicted in Scheme 3 were prepared.

Scheme 4 below illustrates another general procedure for synthesizing N-(heteroarylalkyl)alkanediamine derivatives of formula **I**, *inter alia*, where, for example Ar is pyrid-3-yl (A, where s is 0) substituted with R^1 through R^4, inclusively; a is 1; R^a through R^d, inclusively, are hydrogen; b, c and r are 0:

Scheme 4



q) CH_3CN / reflux; r) *i*-PrEtN / CH_3CN / RT; s) CH_3CN / RT; t) CH_3CN / RT

As depicted in Scheme 4, intermediate **(d)**, for example, the free amine (2-aminoethyl)[(6-chloro(3-pyridyl)methyl][(4-methoxyphenyl)methyl]amine, prepared as set forth above in Scheme 1 and Example 1, was reacted with the known

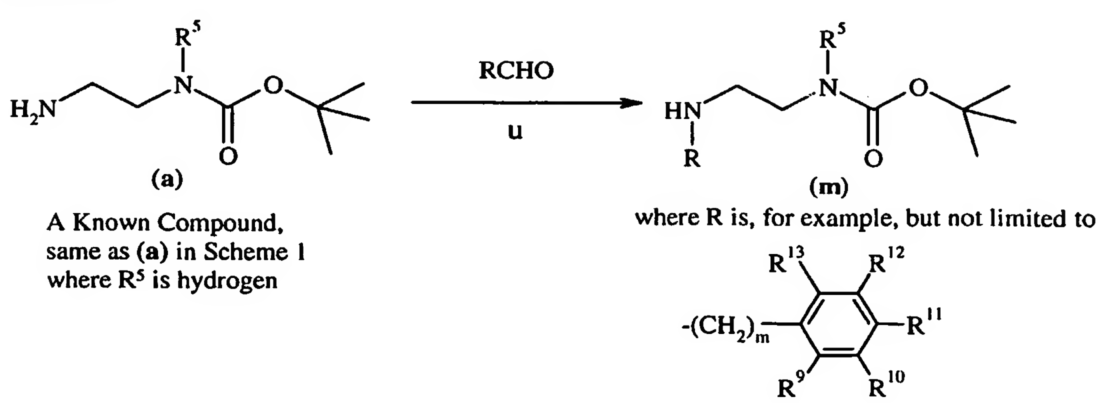
compound (2Z)-2-aza-3-ethoxybut-2-enenitrile, thereby introducing the moiety $-C(XR^6)=WR^7$ into compounds of formula **I**, wherein $-XR^6$ is $-CH_3$, W is –N-, R^7 is $-NO_2$ and d and e are 0. Example 6 set forth below provides in detail the method by which these compounds of formula **I** depicted in Scheme 4 were prepared.

In a similar manner, intermediate **(d)** was reacted under basic conditions with, for example (2Z)-2-aza-3-(diethylamino)-4-chlorobut-2-enenitrile, thereby introducing the moiety $-U_dC(XR^6)=WR^7$ into compounds of formula **I**, wherein d is 1, U is $-CH_2-$, -X- is NR^{36} where R^{36} and R^6 are $-C_2H_5$, W is –N- and R^7 is CN. Example 7 set forth below provides in detail the method by which these compounds of formula **I** depicted in Scheme 4 were prepared.

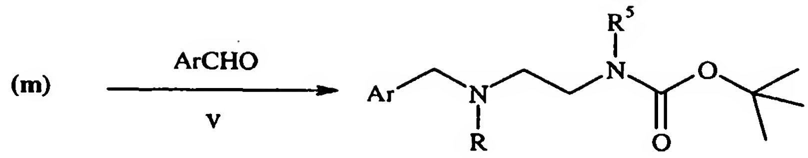
In still a similar manner, intermediate **(d)** was reacted with, for example the known compound (2Z)-2-aza-4-chloro-3-methoxybut-2-enenitrile, thereby introducing the moiety $-C(V_eCl)=WR^7$ into the molecule and depicted as intermediate **(k)**, wherein e is 1, V is $-CH_2-$, W is -N- and R^7 is CN. Intermediate **(k)** was in turn reacted with, for example diethylamine, thereby introducing the moiety XR^6 into compounds of formula **I**, wherein -X- is NR^{36} where R^{36} and R^6 are $-C_2H_5$. Example 8 set forth below provides in detail the method by which these compounds of formula **I** depicted in Scheme 4 were prepared.

Scheme 5 below illustrates another general procedure for synthesizing N-(heteroarylalkyl)alkanediamine derivatives of formula **I**, *inter alia*, where, for example Ar is 1,3-thiazol-5-yl or oxolan-3-yl (B or M, respectively, where s is 0), a is 1; R^a through R^d, inclusively, are hydrogen; b through e, inclusively, and r are 0; W is N and R^7 is $-NO_2$:

Scheme 5

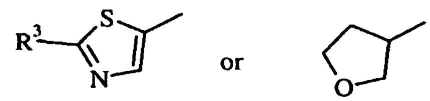


u) $NaBH(OAc)_3$ / $MgSO_4$ / $ClCH_2CH_2Cl$



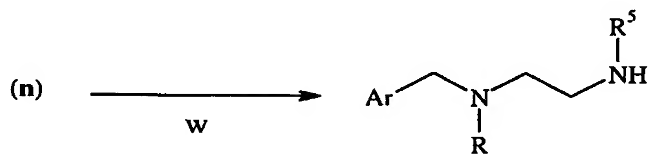
(n)

where Ar is, for example, but not limited to



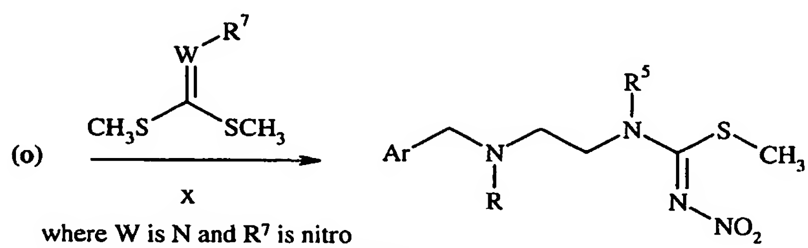
B M

v) $NaBH(OAc)_3$ / $MgSO_4$ / $ClCH_2CH_2Cl$



(o)

w) CF_3COOH / CH_2Cl_2



where W is N and R^7 is nitro is prepared in US patent 5,453,529, now expired

Compounds of formula **I**

x) CH_3CN / 80 °C

As depicted in Scheme 5, which is a variation of the route set forth in Scheme 1, intermediate **(a)**, for example, N-(2-aminoethyl)(*tert*-butoxy)carboxamide was reacted with an appropriate (aryl)formaldehyde, such as 4-methoxybenzaldehyde, yielding, for example (*tert*-butoxy)-N-(2-{[(4-methoxyphenyl)methyl]amino}ethyl)carboxamide **(m)**, wherein moiety R is now (4-methoxyphenyl)methyl. Intermediate **(m)** was in turn reacted in the same manner with an appropriate second (aryl)formaldehyde, such as (2-chloro-1,3-thiazol-5-yl)formaldehyde or (oxolan-3-yl)formaldehyde, thereby introducing the moiety Ar to the molecule, providing intermediate **(n)**, for example (*tert*-butoxy)-N-(2-{[(2-

chloro(1,3-thiazol-5-yl))methyl][(4-methoxyphenyl)methyl]amino}ethyl)carboxamide or (*tert*-butoxy)-N-(2-{[(4-methoxyphenyl)methyl](oxolan-3-ylmethyl)amino}ethyl)carboxamide. Intermediate **(n)** was then treated with an acid, such as trifluoroacetic acid, to remove the amine-protecting (*tert*-butoxy)carboxamide group, affording intermediate **(o)**, for example (2-aminoethyl)[(2-chloro(1,3-thiazol-5-yl))methyl][(4-methoxyphenyl)methyl]amine or (2-aminoethyl)[4-methoxyphenyl)methyl](oxolan-3-ylmethyl)amine. The free amine, intermediate **(o)**, was converted to compounds of formula **(I)** by the reaction of it with an appropriate alkylthio derivative, for example, the known compound dimethyl N-nitroimidodithiocarbonate, thereby introducing the moiety $-C(XR^6)=WR^7$ into the molecule wherein X is S, W is N, R^6 is $-CH_3$ and R^7 is $-NO_2$. Examples 9 and 10 set forth below provide in detail the method by which these compounds of formula **I** depicted in Scheme 5 were prepared.

One skilled in the art will, of course, recognize that the formulation and mode of application of a toxicant may affect the activity of the material in a given application. Thus, for agricultural use the present insecticidal compounds may be formulated as a granular of relatively large particle size (for example, 8/16 or 4/8 US Mesh), as water-soluble or water-dispersible granules, as powdery dusts, as wettable powders, as emulsifiable concentrates, as aqueous emulsions, as solutions, or as any of other known types of agriculturally-useful formulations, depending on the desired mode of application. It is to be understood that the amounts specified in this specification are intended to be approximate only, as if the word "about" were placed in front of the amounts specified.

These insecticidal compositions may be applied either as water-diluted sprays, or dusts, or granules to the areas in which suppression of insects is desired. These formulations may contain as little as 0.1%, 0.2% or 0.5% to as much as 95% or more by weight of active ingredient.

Dusts are free flowing admixtures of the active ingredient with finely divided solids such as talc, natural clays, kieselguhr, flours such as walnut shell and cottonseed flours, and other organic and inorganic solids which act as dispersants and carriers for the toxicant; these finely divided solids have an average particle size of less than about 50 microns. A typical dust formulation useful herein is one containing 1.0 part or less of the insecticidal compound and 99.0 parts of talc.

Wettable powders, also useful formulations for insecticides, are in the form of finely divided particles that disperse readily in water or other dispersant. The wettable powder is ultimately applied to the locus where insect control is needed either as a dry dust or as an emulsion in water or other liquid. Typical carriers for wettable powders include Fuller's earth, kaolin clays, silicas, and other highly absorbent, readily wet inorganic diluents. Wettable powders normally are prepared to contain about 5-80% of active ingredient, depending on the absorbency of the carrier, and usually also contain a small amount of a wetting, dispersing or emulsifying agent to facilitate dispersion. For example, a useful wettable powder formulation contains 80.0 parts of the insecticidal compound, 17.9 parts of Palmetto clay, and 1.0 part of sodium lignosulfonate and 0.3 part of sulfonated aliphatic polyester as wetting agents. Additional wetting agent and/or oil will frequently be added to a tank mix for to facilitate dispersion on the foliage of the plant.

Other useful formulations for insecticidal applications are emulsifiable concentrates (ECs) which are homogeneous liquid compositions dispersible in water or other dispersant, and may consist entirely of the insecticidal compound and a liquid or solid emulsifying agent, or may also contain a liquid carrier, such as xylene, heavy aromatic naphthas, isphorone, or other non-volatile organic solvents. For insecticidal application these concentrates are dispersed in water or other liquid carrier and normally applied as a spray to the area to be treated. The percentage by weight of the essential active ingredient may vary according to the manner in which the composition is to be applied, but in general comprises 0.5 to 95% of active ingredient by weight of the insecticidal composition.

Flowable formulations are similar to ECs, except that the active ingredient is suspended in a liquid carrier, generally water. Flowables, like ECs, may include a small amount of a surfactant, and will typically contain active ingredients in the range of 0.5 to 95%, frequently from 10 to 50%, by weight of the composition. For application, flowables may be diluted in water or other liquid vehicle, and are normally applied as a spray to the area to be treated.

Typical wetting, dispersing or emulsifying agents used in agricultural formulations include, but are not limited to, the alkyl and alkylaryl sulfonates and sulfates and their sodium salts; alkylaryl polyether alcohols; sulfated higher alcohols; polyethylene oxides; sulfonated animal and vegetable oils; sulfonated

petroleum oils; fatty acid esters of polyhydric alcohols and the ethylene oxide addition products of such esters; and the addition product of long-chain mercaptans and ethylene oxide. Many other types of useful surface-active agents are available in commerce. Surface-active agents, when used, normally comprise 1 to 15% by weight of the composition.

Other useful formulations include suspensions of the active ingredient in a relatively non-volatile solvent such as water, corn oil, kerosene, propylene glycol, or other suitable solvents.

Still other useful formulations for insecticidal applications include simple solutions of the active ingredient in a solvent in which it is completely soluble at the desired concentration, such as acetone, alkylated naphthalenes, xylene, or other organic solvents. Granular formulations, wherein the toxicant is carried on relative coarse particles, are of particular utility for aerial distribution or for penetration of cover crop canopy. Pressurized sprays, typically aerosols wherein the active ingredient is dispersed in finely divided form as a result of vaporization of a low-boiling dispersant solvent carrier may also be used. Water-soluble or water-dispersible granules are free flowing, non-dusty, and readily water-soluble or water-miscible. In use by the farmer on the field, the granular formulations, emulsifiable concentrates, flowable concentrates, aqueous emulsions, solutions, etc., may be diluted with water to give a concentration of active ingredient in the range of say 0.1% or 0.2% to 1.5% or 2%.

The active insecticidal and acaricidal compounds of this invention may be formulated and/or applied with one or more second compounds. Such combinations may provide certain advantages, such as, without limitation, exhibiting synergistic effects for greater control of insect pests, reducing rates of application of insecticide thereby minimizing any impact to the environment and to worker safety, controlling a broader spectrum of insect pests, safening of crop plants to phytotoxicity, and improving tolerance by non-pest species, such as mammals and fish.

Second compounds include, without limitation, other pesticides, plant growth regulators, fertilizers, soil conditioners, or other agricultural chemicals. In applying an active compound of this invention, whether formulated alone or with other agricultural chemicals, an effective amount and concentration of the active compound is of course employed; the amount may vary in the range of, e.g. about

0.001 to about 3 kg/ha, preferably about 0.03 to about 1 kg/ha. For field use, where there are losses of insecticide, higher application rates (e.g., four times the rates mentioned above) may be employed.

When the active insecticidal compounds of the present invention are used in combination with one or more of second compounds, e.g., with other pesticides such as herbicides, the herbicides include, without limitation, for example: N-(phosphonomethyl)glycine ("glyphosate"); aryloxyalkanoic acids such as (2,4-dichlorophenoxy)acetic acid ("2,4-D"), (4-chloro-2-methylphenoxy)acetic acid ("MCPA"), (+/-)-2-(4chloro-2-methylphenoxy)propanoic acid ("MCPP"); ureas such as N,N-dimethyl-N'-[4-(1-methylethyl)phenyl]urea ("isoproturon"); imidazolinones such as 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid ("imazapyr"), a reaction product comprising (+/-)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-4-methylbenzoic acid and (+/-)2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-methylbenzoic acid ("imazamethabenz"), (+/-)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid ("imazethapyr"), and (+/-)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-quinolinecarboxylic acid ("imazaquin"); diphenyl ethers such as 5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoic acid ("acifluorfen"), methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate ("bifenox"), and 5-[2-chloro-4-(trifluoromethyl)phenoxy]-N-(methylsulfonyl)-2-nitrobenzamide ("fomasafen"); hydroxybenzonitriles such as 4-hydroxy-3,5-diiodobenzonitrile ("ioxynil") and 3,5-dibromo-4-hydroxybenzonitrile ("bromoxynil"); sulfonylureas such as 2-[[[[(4chloro-6-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]benzoic acid ("chlorimuron"), 2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide (achlorsulfuron"), 2-[[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sufonyl]methyl]benzoic acid ("bensulfuron"), 2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-1-methy-1H-pyrazol-4-carboxylic acid ("pyrazosulfuron"), 3-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]-2-thiophenecarboxylic acid ("thifensulfuron"), and 2-(2-chloroethoxy)-N[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide ("triasulfuron"); 2-(4-aryloxy-

phenoxy)alkanoic acids such as (+/-)-2[4-[(6-chloro-2-benzoxazolyl)oxy]phenoxy]-propanoic acid (fenoxaprop"), (+/-)-2-[4[[5-(trifluoromethyl)-2-pyridinyl]oxy]-phenoxy]propanoic acid ("fluazifop"), (+/-)-2-[4-(6chloro-2-quinoxalinyl)oxy]-phenoxy]propanoic acid ("quizalofop"), and (+ /-) -2-[(2,4-dichlorophenoxy)phenoxy]propanoic acid ("diclofop"); benzothiadiazinones such as 3-(1-methylethyl)-1H-1,2,3-benzothiadiazin-4(3H)-one-2,2-dioxide ("bentazone"); 2-chloroacetanilides such as N-(butoxymethyl)-2-chloro-N-(2,6-diethylphenyl)acetamide ("butachlor"), 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide ("metolachlor"), 2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide ("acetochlor"), and (*RS*)-2-chloro-N-(2,4-dimethyl-3-thienyl)-N-(2-methoxy-1-methylethyl)acetamide ("dimethenamide"); arenecarboxylic acids such as 3,6-dichloro-2-methoxybenzoic acid ("dicamba"); pyridyloxyacetic acids such as [(4-amino-3,5-dichloro-6-fluoro-2-pyridinyl)oxy]acetic acid ("fluroxypyr"), and other herbicides.

When the active insecticidal compounds of the present invention are used in combination with one or more of second compounds, e.g., with other pesticides such as other insecticides, the other insecticides include, for example: organophosphate insecticides, such as chlorpyrifos, diazinon, dimethoate, malathion, parathion-methyl, and terbufos; pyrethroid insecticides, such as fenvalerate, deltamethrin, fenpropathrin, cyfluthrin, flucythrinate, *alpha*-cypermethrin, bifenthrin, cypermethrin, resolved cyhalothrin, etofenprox, esfenvalerate, tralomehtrin, tefluthrin, cycloprothrin, betacyfluthrin, and acrinathrin; carbamate insecticides, such as aldecarb, carbaryl, carbofuran, and methomyl; organochlorine insecticides, such as endosulfan, endrin, heptachlor, and lindane; benzoylurea insecticides, such as diflubenuron, triflumuron, teflubenzuron, chlorfluazuron, flucycloxuron, hexaflumuron, flufenoxuron, and lufenuron; and other insecticides, such as amitraz, clofentezine, fenpyroximate, hexythiazox, spinosad, and imidacloprid.

When the active insecticidal compounds of the present invention are used in combination with one or more of second compounds, e.g., with other pesticides such as fungicides, the fungicides include, for example: benzimidazole fungicides, such as benomyl, carbendazim, thiabendazole, and thiophanate-methyl; 1,2,4-triazole fungicides, such as epoxyconazole, cyproconazole, flusilazole, flutriafol, propiconazole, tebuconazole, triadimefon, and triadimenol; substituted anilide

fungicides, such as metalaxyl, oxadixyl, procymidone, and vinclozolin; organophosphorus fungicides, such as fosetyl, iprobenfos, pyrazophos, edifenphos, and tolclofos-methyl; morpholine fungicides, such as fenpropimorph, tridemorph, and dodemorph; other systemic fungicides, such as fenarimol, imazalil, prochloraz, tricyclazole, and triforine; dithiocarbamate fungicides, such as mancozeb, maneb, propineb, zineb, and ziram; non-systemic fungicides, such as chlorothalonil, dichlofluanid, dithianon, and iprodione, captan, dinocap, dodine, fluazinam, gluazatine, PCNB, pencycuron, quintozene, tricylamide, and validamycin; inorganic fungicides, such as copper and sulphur products, and other fungicides.

When the active insecticidal compounds of the present invention are used in combination with one or more of second compounds, e.g., with other pesticides such as nematicides, the nematicides include, for example: carbofuran, carbosulfan, turbufos, aldecarb, ethoprop, fenamphos, oxamyl, isazofos, cadusafos, and other nematicides.

When the active insecticidal compounds of the present invention are used in combination with one or more of second compounds, e.g., with other materials such as plant growth regulators, the plant growth regulators include, for example: maleic hydrazide, chlormequat, ethephon, gibberellin, mepiquat, thidiazon, inabenfide, triaphenthenol, paclobutrazol, unaconazol, DCPA, prohexadione, trinexapac-ethyl, and other plant growth regulators.

Soil conditioners are materials which, when added to the soil, promote a variety of benefits for the efficacious growth of plants. Soil conditioners are used to reduce soil compaction, promote and increase effectiveness of drainage, improve soil permeability, promote optimum plant nutrient content in the soil, and promote better pesticide and fertilizer incorporation. When the active insecticidal compounds of the present invention are used in combination with one or more of second compounds, e.g., with other materials such as soil conditioners, the soil conditioners include organic matter, such as humus, which promotes retention of cation plant nutrients in the soil; mixtures of cation nutrients, such as calcium, magnesium, potash, sodium, and hydrogen complexes; or microorganism compositions which promote conditions in the soil favorable to plant growth. Such microorganism compositions include, for example, *bacillus, pseudomonas, azotobacter, azospirillum, rhizobium*, and soil-borne *cyanobacteria.*

Fertilizers are plant food supplements, which commonly contain nitrogen, phosphorus, and potassium. When the active insecticidal compounds of the present invention are used in combination with one or more of second compounds, e.g., with other materials such as fertilizers, the fertilizers include nitrogen fertilizers, such as ammonium sulfate, ammonium nitrate, and bone meal; phosphate fertilizers, such as superphosphate, triple superphosphate, ammonium sulfate, and diammonium sulfate; and potassium fertilizers, such as muriate of potash, potassium sulfate, and potassium nitrate, and other fertilizers.

The following examples further illustrate the present invention, but, of course, should not be construed as in any way limiting its scope. The examples are organized to present protocols for the synthesis of the compounds of formula **I** of the present invention, set forth a list of such synthesized species, and set forth certain biological data indicating the efficacy of such compounds.

Example 1

This example illustrates one protocol for the preparation of {2-[((1Z)-1-methylthio-2-nitrovinyl)amino]ethyl}[(6-chloro(3-pyridyl)methyl][(4-methoxyphenyl)methyl]amine (Compound 138).

Step A - Synthesis of a mixture of **i)** N-(2-[bis[6-chloro(3-pyridyl)methyl]amino]ethyl)(*tert*-butoxy)carboxamide and **ii)** (*tert*-butoxy)-N-(2-{[(6-chloro(3-pyridyl))methyl]amino}ethyl)carboxamide as intermediates

A solution of 14.5 grams (0.09 mole) N-(2-aminoethyl)(*tert.*-butoxy)carboxamide (known compound) and 25 mL (excess) of triethylamine in 200 mL of acetonitrile was stirred and a solution of 29.3 grams (0.18 mole) of (6-chloropyrid-3-yl)methyl chloride (known compound) in 100 mL of acetonitrile was added dropwise. Upon completion of addition, the reaction mixture was stirred at ambient temperature during a 24 hour period. After this time the reaction mixture was filtered to collect a solid. The solid was washed with acetonotrile, and the combined wash and filtrate was concentrated under reduced pressure to one half volume. The concentrate was taken up in an aqueous solution saturated with sodium chloride, and the mixture was extracted several times with ethyl acetate. The

combined extracts were dried with sodium sulfate, filtered, and concentrated under reduced pressure to a residue. The gelatinous residue was slurried in methylene chloride and filtered to remove a solid material. The solid was then taken up in an aqueous solution saturated with potassium carbonate and extracted with methylene chloride. The extract was concentrated under reduced pressure to a residual oil. The filtrate set forth above was dissolved in methylene chloride and washed with an aqueous solution saturated with potassium carbonate. The organic layer was concentrated under reduced pressure to a second residual oil. The two residual oils were combined and purified with column chromatography on silica gel. Elution was accomplished using methylene chloride and mixtures of up to 4% methanol in methylene chloride. Appropriate fractions were combined and concentrated under reduced pressure, giving a mixture of predominantly **i)** and **ii)** as a residue. The residue containing **i)** and **ii)** was further purified with column chromatography on silica gel. Elution was accomplished using 2% methanol in methylene chloride. Appropriate fractions were combined and concentrated under reduced pressure, yielding 12.8 grams each of **i)** and **ii)**. The NMR spectra were consistent with the proposed structures.

Step B - Synthesis of (tert-butoxy)-N-(2-{[(6-chloro(3-pyridyl))methyl][(4-methoxyphenyl)methyl]amino}ethyl)carboxamide as an intermediate

A stirred solution of 1.5 grams (0.0052 mole) of (*tert*-butoxy)-N-(2-{[(6-chloro(3-pyridyl))methyl]amino}ethyl)carboxamide and 2.3 mL (0.013 mole) of diisopropylethyl amine in about 15 mL of methylene chloride was cooled to 0 °C, and 0.7 mL (0.0052 mole) of (4-methoxyphenyl)methyl chloride in about 3 mL of methylene chloride was added dropwise. Upon completion of addition the reaction mixture was allowed to warm to ambient temperature, where it stirred during an 18 hour period. After this time, analysis of the reaction mixture by thin layer chromatography (TLC) indicated that no reaction had taken place. The reaction mixture was then heated at reflux for two hours, after which TLC analysis indicated that no reaction had taken place. The methylene chloride solvent was removed under reduced pressure from the reaction mixture, which was replaced with chloroform. The reaction mixture was heated at reflux during one hour, and then it

was allowed to cool to ambient temperature, where it stirred during an 18 hour period. After this time TLC analysis indicated the presence of some reaction product. The reaction mixture was then heated at reflux for about a nine hour period and then it was allowed to cool to ambient temperature as it stirred during an additional 18 hour period. After this time the chloroform solvent was removed under reduced pressure from the reaction mixture, which was replaced with acetonitrile. The reaction mixture was then stirred at ambient temperature during a four hour period, warmed to 60 °C where it stirred for a ten hour period, and finally stirred at ambient temperature during a 60 hour period. The reaction mixture was concentrated under reduced pressure to a residue, and the residue was purified with column chromatography on silica gel. Elution was accomplished using 30% ethyl acetate in hexane. Appropriate fractions were combined and concentrated under reduced pressure, yielding 1.6 grams of the subject compound. The NMR spectrum was consistent with the proposed structure.

Step C - Synthesis of (2-aminoethyl)[(6-chloro(3-pyridyl)methyl][(4-methoxyphenyl)methyl]amine as an intermediate

A stirred aliquot of 1.4 grams (0.0035 mole) of (tert-butoxy)-N-(2-{[(6-chloro(3-pyridyl))methyl][(4-methoxyphenyl)methyl]amino}ethyl)carboxamide was cooled to 0 °C, and 10 mL of trifluoroacetic acid (excess) was added dropwise. Upon completion of addition, the reaction mixture was allowed to warm to ambient temperature where it stirred for one hour. After this time TLC analysis of the reaction mixture indicated that the reaction had gone to completion. The reaction mixture was concentrated under reduced pressure to a residue. The residue was dissolved in methylene chloride and made basic with aqueous 15 % sodium hydroxide. The mixture was extracted several times with methylene chloride, and the combined extracts were dried with sodium sulfate. The mixture was filtered and the filtrate was concentrated under reduced pressure, yielding about 1.0 gram of the subject compound. The NMR spectrum was consistent with the proposed structure.

Step D - Synthesis of Compound 138

A stirred solution of 0.5 gram (0.0016 mole) of (2-aminoethyl)[(6-chloro(3-pyridyl)methyl][(4-methoxyphenyl)methyl]amine, 0.24 gram (0.0016 mole) of 1,1-bis(methylthio)-2-nitroethylene, and a catalytic amount of 4-dimethylaminopyridine in 15 mL of acetonitrile was heated at reflux for 20 hours. After this time the reaction mixture was allowed to cool to ambient temperature as it stirred for an additional 60 hours. The reaction mixture was then concentrated under reduced pressure to a residue. The residue was purified with column chromatography on silica gel. Elution was accomplished using 25% to 40% mixtures of ethyl acetate in hexane. Appropriate fractions were combined and concentrated under reduced pressure, yielding about 0.5 gram of Compound 138. The NMR spectrum was consistent with the proposed structure.

Example 2

This example illustrates one protocol for the preparation of {2-[((1Z)-1-methoxy-2-nitrovinyl)amino]ethyl}[(6-chloro(3-pyridyl)methyl]prop-2-ynylamine (Compound 244).

Step A - Synthesis of (*tert*-butoxy)-N-(2-{[(6-chloro(3-pyridyl))methyl]amino}-ethyl)carboxamide as an intermediate (designated **ii** in Step A of Example 1), an alternate method

A solution of 28.0 grams (0.198 mole) of (6-chloro-3-pyridyl)formaldehyde (known compound), 38.1 grams (0.238 mole) of N-(2-aminoethyl)(tert.-butoxy)carboxamide (known compound), 80.0 grams (0.790 mole) of triethylamine, and 35.7 grams (0.297 mole) of magnesium sulfate in about 1000 mL of methanol was stirred at ambient temperature during an 18 hour period. After this time the reaction mixture was cooled in an ice-water bath, and 44.8 grams (1.188 moles) of sodium borohydride was added portion-wise. Upon completion of addition, the reaction mixture was allowed to warm to ambient temperature as it stirred during an 18 hour period. After this time about 500 mL of water was added to the reaction mixture, which was then concentrated under reduced pressure to remove some of the methanol. The mixture was then extracted with multiple portions of ethyl acetate. The combined extracts were washed with water and then with an aqueous solution

saturated with sodium chloride. The organic layer was dried with magnesium sulfate, filtered, and concentrated under reduced pressure to a residue. The residue was purified with column chromatography on silica gel. Elution was accomplished using hexane, ethyl acetate, and a mixture of 1:9 methanol in ethyl acetate. Appropriate fractions were combined and concentrated under reduced pressure, yielding about 35.9 grams of the subject compound. The NMR spectrum was consistent with the proposed structure.

Step B - Synthesis of (*tert*-butoxy)-N-(2-{[(6-chloro(3-pyridyl)methyl]prop-2-ynylamino}ethyl)carboxamide as an intermediate

A stirred solution of 3.0 grams (0.011 mole) of (*tert*-butoxy)-N-(2-{[(6-chloro(3-pyridyl))methyl]amino}ethyl)carboxamide, 2.3 grams (0.016 mole) of propargyl bromide, and 2.0 grams (0.016 mole) of diethanolamine in 100 mL of acetonitrile was heated to reflux where it was maintained during an 18 hour period. After this time the reaction mixture was cooled and the solvent was removed under reduced pressure to a residue. The residue was dissolved in methylene chloride and washed with three 50 mL portions of water, and then with one 50 mL portion of an aqueous solution saturated with sodium chloride. The organic layer was dried with sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure to a residue. The residue was purified with column chromatography on silica gel. Elution was accomplished using a mixture of 3:1 hexane : ethyl acetate. Appropriate fractions were combined and concentrated under reduced pressure, yielding 2.1 grams of the subject compound. The NMR spectrum was consistent with the proposed structure.

Step C - Synthesis of (2-aminoethyl)[(6-chloro(3-pyridyl)methyl]prop-2-ynylamine as an intermediate

This compound was made in a manner analogous to that set forth in Step C of Example 1, using 2.1 grams (0.0064 mole) of (*tert*-butoxy)-N-(2-{[(6-chloro(3-pyridyl)methyl]prop-2-ynylamino}ethyl)carboxamide and 20 mL (excess) of trifluoroacetic acid in 20 mL of methylene chloride. The yield of the subject

compound was 1.3 grams. The NMR spectrum was consistent with the proposed structure.

Step D - Synthesis of {2-[((1Z)-1-methylthio-2-nitrovinyl)amino]ethyl}[(6-chloro(3-pyridyl)methyl]prop-2-ynylamine (Compound 248) as an intermediate

This compound was made in a manner analogous to that set forth in Step D of Example 1, using 1.3 grams (0.0056 mole) of (2-aminoethyl)[(6-chloro(3-pyridyl)methyl]prop-2-ynylamine and 1.o gram (0.0068 mole) of 1,1-bis(methylthio)-2-nitroethylene in 75 mL of acetonitrile. The reaction product was purified with column chromatography on silica gel. Elution was accomplished using a mixture of 1:1 hexanes : ethyl acetate. Appropriate fractions were combined and concentrated under reduced pressure, yielding 1.1 grams of the subject compound. The NMR spectrum was consistent with the proposed structure.

Step E - Synthesis of Compound 244

A solution of 0.5 gram (0.0015 mole) of Compound 183 and about 0.1 gram (0.0015 mole) of sodium methylate in 20 mL of methanol was stirred at ambient temperature during an 18 hour period. After this time the reaction mixture was concentrated under reduced pressure to a residue. The residue was purified with column chromatography on silica gel. Elution was accomplished using a mixture of 7:3 ethyl acetate : hexanes. Appropriate fractions were combined and concentrated under reduced pressure, yielding about 0.4 gram of Compound 244, mp 114-115 °C. The NMR spectrum was consistent with the proposed structure.

Example 3

This example illustrates one protocol for the preparation of {2-[azanitromethylene)imidazolidinyl]ethyl}[(6-chloro(3-pyridyl))methyl]propylamine (Compound 488).

Step A - Synthesis of 2-{[(6-chloro-3-pyridyl)methyl]amino}ethan-1-ol as an intermediate

This compound was made in a manner analogous to that set forth in Step A of Example 2, using 8.5 grams (0.060 mole) of (6-chloro-3-pyridyl)formaldehyde (known compound), 4.4 grams (0.072 mole) of 2-aminoethan-1-ol, 4.9 grams (0.048 mole) of triethylamine, 14.4 grams (0.119 mole) of magnesium sulfate, and 13.6 grams (0.360 mole) of sodium borohydride in 150 mL of methanol. The yield of the subject compound was about 11.3 grams, which included an impurity of about 10% by weight. The NMR spectrum was consistent with the proposed structure.

Step B - Synthesis of 2{[(6-chloro(3-pyridyl))methyl]propylamino}ethan-1-ol as an intermediate

This compound was made in a manner analogous to that set forth in Step B of Example 2, using 11.3 grams (about 0.055 mole) of 2-{[(6-chloro-3-pyridyl)methyl]amino}ethan-1-ol, 25.4 grams (0.150 mole) of 1-iodopropane, and 14.5 grams (0.143 mole) of triethylamine in 50 mL of acetonitrile. The yield of the subject compound was about 2.2 grams.

Step C - Synthesis of [(6-chloro(3-pyridyl))methyl](2-chloroethyl)propylamine as an intermediate

A stirred solution of 1.0 gram (0.0044 mole) of 2{[(6-chloro(3-pyridyl))methyl]propylamino}ethan-1-ol in two mL of chloroform was cooled to 0 °C, and 2 mL (excess) of thionyl chloride was added dropwise. Upon completion of addition the reaction mixture was allowed to warm to ambient temperature, and then it was heated to reflux where it was stirred for one hour. After this time the reaction mixture was concentrated and made basic with aqueous 10% sodium hydroxide. The mixture was then extracted multiple times with ethyl acetate. The combined extracts were then dried with magnesium sulfate and filtered. The filtrate was concentrated under reduced pressure, yielding about 1.0 gram of the subject compound.

Step D - Synthesis of Compound 488

A stirred solution of 0.90 gram (0.004 mole) of [(6-chloro(3-pyridyl))methyl](2-chloroethyl)propylamine and 0.47 gram (0.004 mole) of 2-(nitromethylene)imidazolidine in 20 mL of DMF was cooled to 0 °C, and 0.19 gram (0.005 mole) of 60% sodium hydride (in mineral oil) was added. Upon completion of addition the reaction mixture was stirred at 0 °C for four hours, then it was allowed to warm to ambient temperature as it stirred during an 18 hour period. After this time the reaction mixture was poured into water, and the mixture was extracted with ethyl acetate. The extract was dried with magnesium sulfate, filtered and concentrated under reduced pressure to a residue. The NMR spectrum indicated that complete reaction had not taken place. The residue was dissolved in DMF and a fresh quantity of 60% sodium hydride in the amount set forth above was added to the reaction mixture. Upon completion of addition the reaction mixture was warmed to 60 to 70 °C where it stirred for two hours. After this time the reaction mixture was worked up as set forth above, yielding 0.63 gram of Compound 488. The NMR spectrum was consistent with the proposed structure.

Example 4

This example illustrates one protocol for the preparation of {2-[4-(azanitromethylene)-5-methyl(1,3,5-oxadiazahydroin-3-yl)]ethyl}bis[6-chloro(3-pyridyl)methyl]amine (Compound 548).

Step A - Synthesis of bis[(6-chloro(3-pyridyl)methyl](2-bromoethyl)amine as an intermediate

This compound was prepared in a manner analogous to that set forth in Steps A-C of Example 3. The yield of subject compound was 3.3 grams. The NMR spectrum was consistent with the proposed structure.

Step B - Synthesis of Compound 548

A stirred solution of 0.62 gram (0.0016 mole) of bis[(6-chloro(3-pyridyl)methyl](2-bromoethyl)amine, 0.25 gram (0.0015 mole) of 4-(azanitromethylene)-3-methyl-1,3,5-oxadiazaperhydroine (prepared by the method

of P. Maienfisch et al; Pest Management Science 165-176 (2001); is Compound 17c in this paper) and 0.32 gram (0.0023 mole) of potassium carbonate in 20 mL of DMF was heated to 70 °C where it was maintained for three hours. After this time the reaction mixture was allowed to cool to ambient temperature where it stood for 40 hours. The reaction mixture was then filtered and concentrated under reduced pressure to a residue. The residue was dissolved in ethyl acetate and washed with water. The organic layer was dried with sodium sulfate and filtered. The filtrate was purified with column chromatography on silica gel. Elution was accomplished using ethyl acetate and 10% methanol in methylene chloride as eluants. Appropriate fractions were combined and concentrated under reduced pressure, yielding 0.45 gram of Compound 548. The NMR spectrum was consistent with the proposed structure.

Example 5

This example illustrates one protocol for the preparation of [(6-chloro(3-pyridyl)))methyl][(2-chlorophenyl)methyl]{2-(nitromethyleneimidazolidinyl]ethyl}-amine (Compound 501).

Step A - Synthesis of (*tert*-butoxy)-N-{2-[2-(nitromethlene)imidazolidinyl]ethyl}-carboxamide as an intermediate

A stirred mixture of 2.03 gram (0.010 mole) of N-{2-[(2-aminoethyl)amino]ethyl}(*tert*-butoxy)carboxamide (commercially available), 1.18 gram (0.010 mole) of 1,1-di(methylthio)-2-nitroethene and 2 mL (excess) of triethylamine in 40 mL of acetonitrile was warmed to reflux where it was maintained for four hours. After this time the reaction mixture was concentrated under reduced pressure to a solid residue. The residue was washed with diethyl ether and dried, yielding 1.76 grams of the subject compound. The NMR spectrum was consistent with the proposed structure.

Step B - Synthesis of 2-[2-(nitromethylene)imidazolidinyl]ethylamine, acetic acid salt as an intermediate

With stirring and cooling in an ice-water bath (0 °C), 0.40 gram (0.0015 mole) of (*tert*-butoxy)-N-{2-[2-(nitromethlene)imidazolidinyl]ethyl}carboxamide and 2 mL of trifluoroacetic acid (excess) in 10 mL of methylene chloride were combined. Upon completion of addition, the ice-water bath was removed, and the reaction mixture was allowed to warm to ambient temperature as it stirred during an 18 hour period. After this time the reaction mixture was concentrated under reduced pressure to a residue. The residue was stirred with 10 mL of acetonitrile and 50 mL of diethyl ether, to precipitate a solid. The solid was collected by filtration and dried, yielding 0.4 gram of the subject compound. The NMR spectrum was consistent with the proposed structure.

Step C - Synthesis of [(6-chloro(3-pyridyl))methyl]{2-[2-(nitromethylene)-imidazolidinyl]ethyl]amine as an intermediate

With stirring and cooling in an ice-water-salt bath (-5 °C), 0.14 gram (0.0005 mole) of 2-[2-(nitromethylene)imidazolidinyl]ethylamine, acetic acid salt, 0.09 gram (0.0006 mole) of (6-chloro-3-pyridyl)formaldehyde, 0.05 gram (0.0008 mole) of sodium cyanoborohydride and 0.5 mL of acetic acid in 10 mL of methanol were combined. Upon completion of addition, the cooling bath was removed and the reaction mixture was allowed to warm to ambient temperature as it stirred during an 18 hour period. After this time the reaction mixture was neutralized to a pH of 8 using aqueous 10% ammonium hydroxide. The mixture was then extracted with two 50 mL portions of methylene chloride. The combined extracts were dried with sodium sulfate, filtered and the filtrate was concentrated under reduced pressure to a residue. The residue was purified with column chromatography on silica gel. Elution was accomplished using mixtures of methanol and methylene chloride as eluants. Appropriate fractions were combined and concentrated under reduced pressure, yielding 0.05 gram of the subject compound. The NMR spectrum was consistent with the proposed structure. Steps A-C were repeated to obtain additional intermediate with which to continue.

Step D - Synthesis of Compound 501

With stirring and cooling in an ice-water bath (0 °C) 0.12 grams (0.0004 mole) of [(6-chloro(3-pyridyl))methyl]{2-[2-(nitromethylene)imidazolidinyl]ethyl]amine, 0.06 gram (0.0004 mole) of 2-chlorobenzaldehyde, 0.13 gram (0.0006 mole) of sodium triacetoxyborohydride and 0.10 gram (0.0008 mole) of magnesium sulfate in about 20 mL of 1,2-dichloroethane were combined. Upon completion of addition, the cooling bath was removed and the reaction mixture was allowed to warm to ambient temperature as it stirred during an 18 hour period. After this time the reaction was quenched by the addition of five mL of water, then the reaction mixture was neutralized to pH of 8-9. The reaction mixture was then extracted with two 50 mL portions of methylene chloride. The combined extracts were dried with sodium sulfate, filtered and concentrated under reduced pressure, yielding 0.07 gram of Compound 501. The NMR spectrum was consistent with the proposed structure.

Example 6

This example illustrates one protocol for the preparation of (2E)-2-aza-3-[(2-{[(6-chloro(3-pyridyl))methyl][(4-methoxyphenyl)methyl]amino}ethyl)amino]but-2-enenitrile (Compound 178).

A stirred solution of 0.2 gram (0.0007 mole) of (2-aminoethyl)[(6-chloro(3-pyridyl)methyl][(4-methoxyphenyl)methyl]amine (prepared in Steps A-C of Example 1) and 0.11 gram (0.0010 mole) of (2Z)-2-aza-3-ethoxybut-2-enenitrile (known compound) in 10 mL of acetonitrile was warmed to reflux where it was maintained during a two hour period. After this time the cooled reaction mixture was purified with column chromatography on silica gel. Elution was accomplished using 85% ethyl acetate in hexane as an eluant. Appropriate fractions were combined and concentrated under reduced pressure, yielding 0.14 gram of the Compound 178. The NMR spectrum was consistent with the proposed structure.

Example 7

This example illustrates one protocol for the preparation of (2Z)-2-aza-3-(diethylamino)-4-[(2-{[(6-chloro(3-pyridyl))methyl][(4-methoxyphenyl)methyl]amino}ethyl)amino]but-2-enenitrile (Compound 181).

Step A - Synthesis of (2Z)-2-aza-3-(diethylamino)-4-chlorobut-2-enenitrile as an internediate

A solution of 0.5 gram (0.0038 mole) of (2Z)-2-aza-4-chloro-3-methoxybut-2-enenitrile (known compound) in 10 mL of acetonitrile was stirred, and 0.3 gram (0.0042 mole) of diethylamine was added. Upon completion of addition, the reaction mixture was stirred for an additional 30 minutes, then it was absorbed in silica gel. The mixture was then purified by column chromatography. Elution was accomplished using methylene chloride as an eluant. Appropriate fractions were combined and concentrated under reduced pressure, yielding 0.32 gram of the subject compound. The NMR spectrum was consistent with the proposed structure.

Step B - Synthesis of Compound 181

A solution of 0.25 gram (0.0008 mole) of (2-aminoethyl)[(6-chloro(3-pyridyl)methyl][(4-methoxyphenyl)methyl]amine (prepared in Steps A-C of Example 1), 0.14 gram (0.0008 mole) of (2Z)-2-aza-3-(diethylamino)-4-chlorobut-2-enenitrile and 0.13 gram (0.0010 mole) of N,N-diisopropylethylamine in 10 mL of acetonitrile was stirred at ambient temperature during a 48 hour period. After this time a solid was collected by filtration. The solid was washed with diethyl ether and dried, yielding 0.25 gram of Compound 181; mp 68-72 °C. The NMR spectrum was consistent with the proposed structure.

Example 8

This example illustrates one protocol for the preparation of (2E)-2-aza-4-(diethylamino)-3-[(2-{[(6-chloro(3-pyridyl))methyl][(4-methoxyphenyl)methyl]amino}ethyl)amino]but-2-enenitrile (Compound 183).

Step A - Synthesis of (2E)-2-aza-4-chloro-3-[(2-{[(6-chloro(3-pyridyl))methyl][(4-methoxyphenyl)methyl]amino}ethyl)amino]but-2-enenitrile as an intermediate

A solution of 0.50 gram (0.0016 mole) of (2-aminoethyl)[(6-chloro(3-pyridyl)methyl][(4-methoxyphenyl)methyl]amine (prepared in Steps A-C of

Example 1) and 0.32 gram (0.0024 mole) of (2Z)-2-aza-4-chloro-3-methoxybut-2-enenitrile (known compound) in 10 mL of acetonitrile was stirred at ambient temperature during a 30 minute period. After this time the reaction mixture was absorbed in silica gel, and purified by column chromatography. Elution was accomplished using methylene chloride, then ethyl acetate as eluants. Appropriate fractions were combined and concentrated under reduced pressure, yielding 0.47 gram of the subject compound. The NMR spectrum was consistent with the proposed structure.

Step B - Synthesis of Compound 183

A solution of 0.3 gram (0.0007 mole) of (2E)-2-aza-4-chloro-3-[(2-{[(6-chloro(3-pyridyl))methyl][(4-methoxyphenyl)methyl]amino}ethyl)amino]but-2-enenitrile and 0.11 gram (0.0015 mole) of diethylamine in about 10 mL of acetonitrile was stirred at ambient temperature during a 48 hour period. After this time the reaction mixture was dissolved in 100 mL of methylene chloride and washed with 50 mL of aqueous 5% sodium carbonate. The organic layer was dried with magnesium sulfate, filtered, and the filtrate was concentrated under reduced pressure to a residue. The residue was purified with column chromatography on silica gel. Elution was accomplished using 75% diethyl ether in hexane and 100% diethyl ether as eluants. Appropriate fractions were combined and concentrated under reduced pressure, yielding 0.30 gram of Compound 183. The NMR spectrum was consistent with the proposed structure.

Example 9

This example illustrates one protocol for the preparation of {2-[((1Z)-2-aza-1-methylthio-2-nitrovinyl)amino]ethyl}[(2-chloro(1,3-thiazol-5-yl))methyl][(4-methoxyphenyl)methyl]amine (Compound 300).

Step A - Synthesis of (*tert*-butoxy)-N-(2-{[(4-methoxyphenyl)methyl]amino}-ethyl)carboxamide as an intermediate

This compound was made in a manner analogous to that set forth in Step D of Example 5, using 3.0 grams (0.022 mole) of 4-methoxybenzaldehyde, 3.6 grams (0.022 mole) of N-(2-aminoethyl)(*tert*-butoxy)carboxamide (known compound), 7.0 grams (0.033 mole) of sodium triacetoxyborohydride and 5.3 grams (0.044 mole) of magnesium sulfate in 30 mL of 1,2-dichloroethane. The reaction product was purified with column chromatography on silica gel. Elution was accomplished using mixtures of 2% to 5% methanol in methylene chloride as eluants. Appropriate fractions were combined and concentrated under reduced pressure, yielding 0.72 gram of the subject compound. The NMR spectrum was consistent with the proposed structure. The reaction was repeated to obtain additional material.

Step B - Synthesis of (*tert*-butoxy)-N-(2-{[(2-chloro(1,3-thiazol-5-yl))methyl][(4-methoxyphenyl)methyl]amino}ethyl)carboxamide as an intermediate

This compound was also made in a manner analogous to that set forth in Step D of Example 5, and Step A above, using 0.25 gram (0.0017 mole) of (2-chloro-1,3-thiazol-5-yl)formaldehyde, 0.47 gram (0.0017 mole) of (*tert*-butoxy)-N-(2-{[(4-methoxyphenyl)methyl]amino}ethyl)carboxamide, 0.54 gram (0.0025 mole) of sodium triacetoxyborohydride and 0.40 gram (0.0034 mole) of magnesium sulfate in about 10 mL of 1,2-dichloroethane. The reaction product was purified with column chromatography on silica gel. In a first chromatography, elution was accomplished using mixtures of 2% to 5% methanol in methylene chloride as eluants. In a second chromatography, elution was accomplished using a mixture of 1.5% methanol in methylene chloride as an eluant. Appropriate fractions were combined and concentrated under reduced pressure, yielding 0.48 gram of the subject compound. The NMR spectrum was consistent with the proposed structure.

Step C - Synthesis of (2-aminoethyl)[(2-chloro(1,3-thiazol-5-yl))methyl][(4-methoxyphenyl)methyl]amine as an intermediate

This compound was made in a manner analogous to that set forth in Step C of Example 1, using 0.3 gram (0.0007 mole) of (*tert*-butoxy)-N-(2-{[(2-chloro(1,3-thiazol-5-yl))methyl][(4-methoxyphenyl)methyl]amino}ethyl)carboxamide and 3

mL (excess) of trifluoroacetic acid in 20 mL of methylene chloride. The yield of subject compound was 0.20 gram. The NMR spectrum was consistent with the proposed structure.

Step D - Synthesis of Compound 300

This compound was made in a manner analogous to that set forth in Step D of Example 1, using 0.20 gram (0.0006 mole) of (2-aminoethyl)[(2-chloro(1,3-thiazol-5-yl))methyl][(4-methoxyphenyl)methyl]amine and 0.18 gram (0.0011 mole) of dimethyl N-nitroimidodithiocarbonate in 40 mL of acetonitrile. The reaction product was purified with column chromatography on silica gel. Elution was accomplished using mixtures of 15% and 50% ethyl acetate in hexane as eluants. Appropriate fractions were combined and concentrated under reduced pressure, yielding 0.23 gram of Compound 300. The NMR spectrum was consistent with the proposed structure.

Example 10

This example illustrates one protocol for the preparation of {2-[((1Z)-2-aza-1-methylthio-2-nitrovinyl)amino]ethyl}[(4-methoxyphenyl)methyl](oxolan-3-ylmethyl)amine (Compound 486).

Step A - Synthesis of (*tert*-butoxy)-N-(2-{[(4-methoxyphenyl)methyl](oxolan-3-ylmethyl)amino}ethyl)carboxamide as an intermediate

This compound was made in a manner analogous to that set forth in Step D of Example 5, using 0.2 gram (0.0020 mole) of (oxolan-3-yl)formaldehyde, 0.56 gram (0.0020 mole) of (*tert*-butoxy)-N-(2-{[(4-methoxyphenyl)methyl]amino}-ethyl)carboxamide (prepared in Step A of Example 9), 0.64 gram (0.0030 mole) of sodium triacetoxyborohydride and 2.5 grams (0.021 mole) of magnesium sulfate in 50 mL of 1,2-dichloroethane. The reaction product was purified with column chromatography on silica gel. Elution was accomplished using a mixture of 1% methanol in methylene chloride as an eluant. Appropriate fractions were combined and concentrated under reduced pressure, yielding 0.59 gram of the subject compound. The NMR spectrum was consistent with the proposed structure.

Step B - Synthesis of (2-aminoethyl)[4-methoxyphenyl)methyl](oxolan-3-ylmethyl)amine as an intermediate

This compound was made in a manner analogous to that set forth in Step C of Example 1, using 0.3 gram (0.00082 mole) of (*tert*-butoxy)-N-(2-{[(4-methoxyphenyl)methyl](oxolan-3-ylmethyl)amino}ethyl)carboxamide and 3 mL (excess) of trifluoroacetic acid in 20 mL of methylene chloride. The yield of subject compound was 0.22 gram. The NMR spectrum was consistent with the proposed structure.

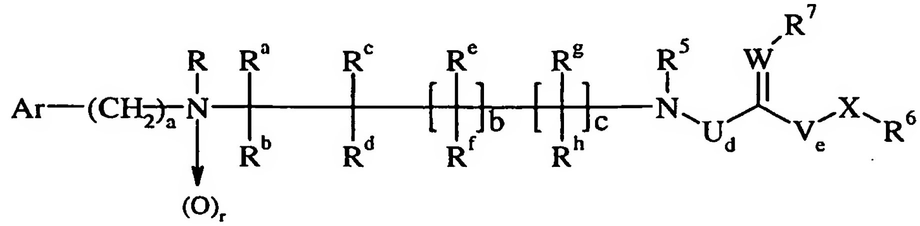
Step C - Synthesis of Compound 486

This compound was made in a manner analogous to that set forth in Step D of Example 1, using 0.22 gram (0.0008 mole) of (2-aminoethyl)[4-methoxyphenyl)methyl](oxolan-3-ylmethyl)amine and 0.21 gram (0.0012 mole) of dimethyl N-nitroimidodithiocarbonate in 35 mL of acetonitrile. The reaction product was purified with column chromatography on silica gel. Elution was accomplished using mixtures of 15% and 50% ethyl acetate in hexane as eluants. Appropriate fractions were combined and concentrated under reduced pressure, yielding 0.23 gram of Compound 486. The NMR spectrum was consistent with the proposed structure.

It is well known to one of ordinary skill in the art that compounds like the compounds of formula **I** of the present invention can contain optically active and racemic forms. It is also well known in the art that compounds like the compounds of formula **I** may contain stereoisomeric forms, tautomeric forms and/or exhibit polymorphism. It is to be understood that the present invention encompasses any racemic, optically active, polymorphic, tautomeric, or stereoisomeric form, or mixtures thereof. It should be noted that it is well known in the art how to prepare optically active forms, for example by resolution of a racemic mixture, or by synthesis from optically active intermediates.

The following table sets forth some additional examples of compounds of formula **I** useful in the present invention:

Table 1
Insecticidal N-(Heteroarylalkyl)alkanediamine Derivatives



I

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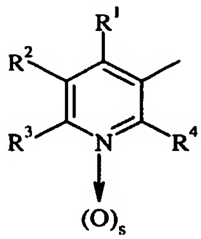
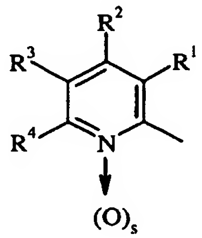
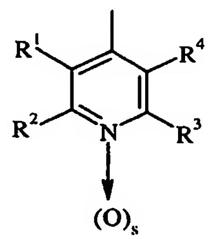


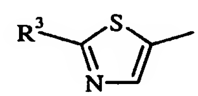
A
pyrid-3-yl



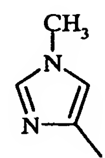
A1
pyrid-2-yl



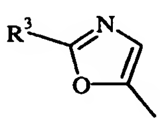
A2
pyrid-4-yl



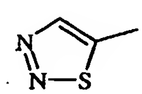
B
1,3-thiazol-5-yl



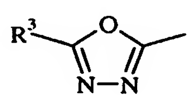
C
1-methyl-imidazol-4-yl



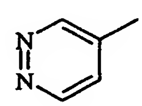
D
1,3-oxazol-5-yl



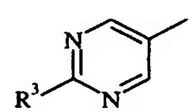
E
1,2,3-thia-diazol-5-yl



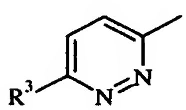
F
1,3,4-oxa-diazol-2-yl



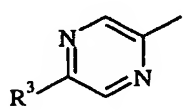
G
pyridazin-4-yl



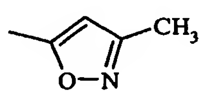
H
pyrimidin-5-yl



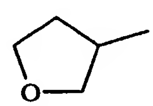
J
pyridazin-3-yl



K
pyrazin-5-yl

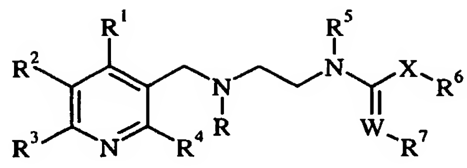


L
3-methyl-isoxazol-5-yl



M
oxolan-3-yl

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R^3 is chloro; W is CR^{33} where R^{33} is hydrogen; and R^7 is NO_2:



I

Cmpd No	R	X	R^6	R^{34}	R^{35}	R^{36}
1	$C_2H_4CH_2F$	O	CH_3	--	--	--
2	$C_2H_4CH_2F$	S	CH_3	--	--	--
3	$C_2H_4CF_3$	S	CH_3	--	--	--
4	$C_2H_4OCH_3$	S	CH_3	--	--	--
5	$C_2H_4OC_2H_5$	S	CH_3	--	--	--
6	$C_2H_4OC_2H_4OCH_3$	O	CH_3	--	--	--
7	$C_2H_4OC_2H_4OCH_3$	S	CH_3	--	--	--
8	$C_2H_4OC_2H_4OCH_3$	O	$C_2H_4OCH_3$	--	--	--
9	OH	S	CH_3	--	--	--
10	$CH_2C{\equiv}N$	S	CH_3	--	--	--
11	$C(=O)CH_3$	S	CH_3	--	--	--
12	SO_2CH_3	S	CH_3	--	--	--
13	$P(O)(OC_2H_5)_2$	S	CH_3	--	--	--
14	oxolan-3-ylmethyl	S	CH_3	--	--	--
15	2H-3,4,5,6-tetrahydropyran-2-ylmethyl	S	CH_3	--	--	--
16	cyclohex-1-en-3-yl	S	CH_3	--	--	--
17	thien-3-ylmethyl	S	CH_3	--	--	--
18	furan-2-ylmethyl	S	CH_3	--	--	--
19	furan-3-ylmethyl	S	CH_3	--	--	--
20	benzo[b]furan-2-ylmethyl	S	CH_3	--	--	--
21	$C_2H_4CH_2F$	$CR^{34}R^{35}$	H	H	H	--
22	$C_2H_4CF_3$	$CR^{34}R^{35}$	H	H	H	--
23	$C_2H_4OCH_3$	$CR^{34}R^{35}$	H	H	H	--
24	$C_2H_4OC_2H_5$	$CR^{34}R^{35}$	H	H	H	--
25	$C_2H_4OC_2H_4OCH_3$	$CR^{34}R^{35}$	H	H	H	--
26	OH	$CR^{34}R^{35}$	H	H	H	--
27	$CH_2C{\equiv}N$	$CR^{34}R^{35}$	H	H	H	--
28	$C(=O)CH_3$	$CR^{34}R^{35}$	H	H	H	--
29	SO_2CH_3	$CR^{34}R^{35}$	H	H	H	--
30	$P(O)(OC_2H_5)_2$	$CR^{34}R^{35}$	H	H	H	--
31	oxolan-3-ylmethyl	$CR^{34}R^{35}$	H	H	H	--
32	2H-3,4,5,6-tetrahydropyran-2-ylmethyl	$CR^{34}R^{35}$	H	H	H	--
33	cyclohex-1-en-3-yl	$CR^{34}R^{35}$	H	H	H	--
34	thien-3-ylmethyl	$CR^{34}R^{35}$	H	H	H	--
35	furan-2-ylmethyl	$CR^{34}R^{35}$	H	H	H	--
36	furan-3-ylmethyl	$CR^{34}R^{35}$	H	H	H	--
37	benzo[b]furan-2-ylmethyl	$CR^{34}R^{35}$	H	H	H	--
38	CHO	S	CH_3	--	--	--
39	$CO_2C(CH_3)_3$	S	CH_3	--	--	--
40[1]	$-(CH_2)_mCR^{14}=CR^{15}R^{16}$	O	CH_3	--	--	--
41	C_2H_5	O	CH_3	--	--	--
42	C_2H_5	NR^{36}	CH_3	--	--	H
43	$CH_2C{\equiv}N$	NR^{36}	CH_3	--	--	H
44	H	NR^{36}	CH_3	--	--	CH_3

[1]where m is 1 and R^{14}, R^{15} and R^{16} are hydrogen

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R^3 is chloro; W is N; and R^7 is NO_2:

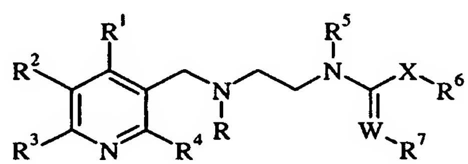
Cmpd. No.	R	X	R^6	R^{36}
45	$C_2H_4CH_2F$	O	CH_3	--
46	$C_2H_4CH_2F$	S	CH_3	--
47	$C_2H_4CF_3$	S	CH_3	--
48	$C_2H_4OCH_3$	S	CH_3	--
49	$C_2H_4OC_2H_5$	S	CH_3	--
50	$C_2H_4OC_2H_4OCH_3$	O	CH_3	--
51	$C_2H_4OC_2H_4OCH_3$	S	CH_3	--
52	$C_2H_4OC_2H_4OCH_3$	O	$C_2H_4OCH_3$	--
53	OH	S	CH_3	--
54	$CH_2C{\equiv}N$	S	CH_3	--
55	$C(=O)CH_3$	S	CH_3	--
56	SO_2CH_3	S	CH_3	--
57	$P(O)(OC_2H_5)_2$	S	CH_3	--
58	oxolan-3-ylmethyl	S	CH_3	--
59	2H-3,4,5,6-tetrahydropyran-2-ylmethyl	S	CH_3	--
60	cyclohex-1-en-3-yl	S	CH_3	--
61	thien-3-ylmethyl	S	CH_3	--
62	furan-2-ylmethyl	S	CH_3	--
63	furan-3-ylmethyl	S	CH_3	--
64	benzo[b]furan-2-ylmethyl	S	CH_3	--
65	CH_2CH_3	S	CH_3	--
66	$CH(CH_3)_2$	S	CH_3	--
67	$CH_2CH(CH_3)_2$	S	CH_3	--
68	CH_2-cyclopropyl	S	CH_3	--
69	CH_2-cyclobutyl	S	CH_3	--
70	CH_2-cyclohexyl	S	CH_3	--
71	CH_2CH_2F	S	CH_3	--
72	CHO	S	CH_3	--
73	$CO_2C(CH_3)_3$	S	CH_3	--
74	H	NR^{36}	CH_3	H
75	$CO_2C(CH_3)_3$	NR^{36}	CH_3	H

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R^3 is chloro; W is N; and R^7 is $C{\equiv}N$:

Cmpd No.	R	X	R^6	R^{36}
76	$C_2H_4CH_2F$	O	CH_3	--
77	$C_2H_4CH_2F$	S	CH_3	--
78	$C_2H_4CF_3$	S	CH_3	--
79	$C_2H_4OCH_3$	S	CH_3	--
80	$C_2H_4OC_2H_5$	S	CH_3	--
81	$C_2H_4OC_2H_4OCH_3$	O	CH_3	--
82	$C_2H_4OC_2H_4OCH_3$	S	CH_3	--
83	$C_2H_4OC_2H_4OCH_3$	O	$C_2H_4OCH_3$	--

Cmpd No.	R	X	R^6	R^{36}
84	OH	S	CH_3	--
85	$CH_2C{\equiv}N$	S	CH_3	--
86	$C(=O)CH_3$	S	CH_3	--
87	SO_2CH_3	S	CH_3	--
88	$P(O)(OC_2H_5)_2$	S	CH_3	--
89	oxolan-3-ylmethyl	S	CH_3	--
90	2H-3,4,5,6-tetrahydropyran-2-ylmethyl	S	CH_3	--
91	cyclohex-1-en-3-yl	S	CH_3	--
92	thien-3-ylmethyl	S	CH_3	--
93	furan-2-ylmethyl	S	CH_3	--
94	furan-3-ylmethyl	S	CH_3	--
95	benzo[b]furan-2-ylmethyl	S	CH_3	--
96	$CH\ (CH_3)_2$	S	CH_3	--
97	$C(=O)H$	S	CH_3	--
98	$C(=O)O$*t*-Bu	S	CH_3	--
99	$C(=O)O$*t*-Bu	NR^{36}	CH_3	H

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R^3 is chloro; W is CR^{33} where R^{33} is hydrogen; X is S; R^6 is CH_3; and R^7 is NO_2:



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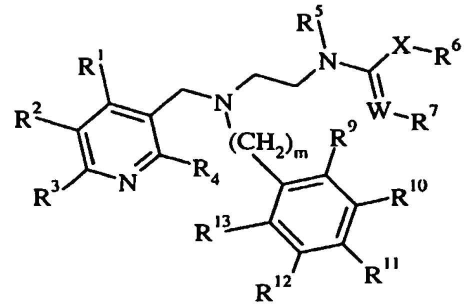
Cmpd. No.	R	R^8
100	2-R^8-1,3-thiazol-4-ylmethyl	Cl
101	2-R^8-1,3-thiazol-4-ylmethyl	CH_3
102	2-R^8-1,3-thiazol-4-ylmethyl	4-Cl-Ph
103	5-R^8-1,2,4-oxadiazol-3-ylmethyl	2-OCH_3-Ph
104	5-R^8-1,2,4-oxadiazol-3-ylmethyl	3-OCH_3-Ph
105	5-R^8-1,2,4-oxadiazol-3-ylmethyl	4-OCH_3-Ph
106	5-R^8-1,2,4-oxadiazol-3-ylmethyl	4-CF_3-Ph
107	5-R^8-1,2,4-oxadiazol-3-ylmethyl	3,5-di(CH_3)-isoxazol-4-yl

where Ar is A; a is 1, unless otherwise noted; b, c, d and e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R is $-(CH_2)_m$-phenyl, wherein phenyl is substituted with R^9 through R^{13}, inclusively; X is S, unless otherwise noted; and R^7 is NO_2:



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Cmpd No.	m	R^3	R^6	R^9	R^{10}	R^{11}	R^{12}	R^{13}	W	R^{33}
108	1	Cl	CH_3	H	H	H	H	H	CR^{33}	H
109	3	Cl	CH_3	H	H	H	H	H	CR^{33}	H
110	1	Cl	CH_3	Cl	H	H	H	H	CR^{33}	H
111	1	Cl	CH_3	H	Cl	H	H	H	CR^{33}	H
112	1	Cl	CH_3	H	H	Cl	H	H	CR^{33}	H
113	1	Br	CH_3	H	H	Cl	H	H	CR^{33}	H
114	1	F	CH_3	H	H	Cl	H	H	CR^{33}	H
115	3	Cl	CH_3	H	H	Cl	H	H	CR^{33}	H
116	1	Cl	CH_3	F	F	F	F	F	CR^{33}	H
117	1	Cl	CH_3	H	H	C≡N	H	H	CR^{33}	H
118	1	Cl	CH_3	H	H	NO_2	H	H	CR^{33}	H
119	1	Cl	CH_3	CH_3	H	H	H	H	CR^{33}	H
120	1	Cl	CH_3	H	CH_3	H	H	H	CR^{33}	H
121	1	Cl	CH_3	H	H	CH_3	H	H	CR^{33}	H
122	1	Br	CH_3	H	H	CH_3	H	H	N	--
123	1	Br	CH_3	H	H	OCH_3	H	H	CR^{33}	H
124	1	F	CH_3	H	H	OCH_3	H	H	CR^{33}	H
125	1	Cl	CH_3	H	H	$C(CH_3)_3$	H	H	CR^{33}	H
126	1	Cl	CH_3	CH_3	CH_3	H	H	H	CR^{33}	H
127	1	Cl	CH_3	CH_3	H	CH_3	H	H	CR^{33}	H
128	1	Cl	CH_3	CH_3	H	H	CH_3	H	CR^{33}	H
129	1	Cl	CH_3	CH_3	H	H	H	CH_3	CR^{33}	H
130	1	Cl	CH_3	H	CH_3	CH_3	H	H	CR^{33}	H
131	1	Cl	CH_3	H	CH_3	H	CH_3	H	CR^{33}	H
132	1	Cl	CH_3	CH_3	H	CH_3	H	CH_3	CR^{33}	H
133	1	Cl	CH_3	H	H	CF_3	H	H	CR^{33}	H
134	1	Cl	CH_3	H	H	Ph	H	H	CR^{33}	H
135	1	Cl	CH_3	CH_3	Ph	H	H	H	CR^{33}	H
136	1	Cl	CH_3	OCH_3	H	H	H	H	CR^{33}	H
137	1	Cl	CH_3	H	OCH_3	H	H	H	CR^{33}	H
138	1	Cl	CH_3	H	H	OCH_3	H	H	CR^{33}	H

Cmpd No.	m	R^3	R^6	R^9	R^{10}	R^{11}	R^{12}	R^{13}	W	R^{33}
[1]139	1	Cl	CH_3	H	H	OCH_3	H	H	N	--
140	1	Cl	CH_3	H	H	OCH_3	H	H	N	--
141	1	Cl	CH_3	H	OPh	H	H	H	CR^{33}	H
142	1	Cl	CH_3	H	H	$CH{=}NOC_2H_5$	H	H	CR^{33}	H
143	1	Cl	CH_3	H	H	2-ethyl-2H-tetrazol-5-yl	H	H	CR^{33}	H
144	1	Cl	CH_2-c-hexyl	H	H	H	H	H	CR^{33}	H
145	1	Cl	CH_3	H	H	H	H	H	N	--
146	1	Cl	CH_3	H	H	CF_3	H	H	N	--
147	1	Cl	CH_3	H	H	F	H	H	N	--
148	1	Cl	CH_3	H	OCH_3	H	H	H	N	--
149	1	Cl	CH_3	H	H	OCF_3	H	H	N	--
150	1	Cl	CH_3	H	H	CN	H	H	N	--
151	1	Cl	CH_3	H	Cl	H	Cl	H	N	--
152	1	Cl	CH_3	H	H	F	H	H	CR^{33}	H
153	1	Cl	CH_3	H	H	OCF_3	H	H	CR^{33}	H
154	1	Cl	CH_3	H	H	Cl	H	H	N	--
155	1	Cl	CH_3	H	Cl	H	H	H	N	--
156	1	Cl	CH_3	OCH_3	H	H	H	H	N	--
157	1	Cl	CH_3	H	H	CH_3	H	H	N	--
158	1	Cl	$CH(CH_3)_2$	H	H	OCH_3	H	H	N	--
159	1	H	CH_3	H	H	OCH_3	H	H	N	--
160	1	OCH_3	CH_3	H	H	OCH_3	H	H	N	--
161	1	CF_3	CH_3	H	H	OCH_3	H	H	N	--
[2]162	1	Cl	CH_3	H	H	OCH_3	H	H	CR^{33}	H
163	1	Cl	CH_3	OCH_3	H	H	OCH_3	H	N	--
[3]164	1	Cl	C_2H_5	H	H	OCH_3	H	H	N	--
[4]165	1	Cl	C_2H_5	H	H	OCH_3	H	H	N	--
166	1	Cl	C_2H_5	H	H	OCH_3	H	H	N	--
167	1	CH_3	CH_3	H	H	OCH_3	H	H	N	--
168	1	F	CH_3	H	H	OCH_3	H	H	N	--
169	1	Cl	$C_2H_4OCH_3$	H	H	OCH_3	H	H	N	--

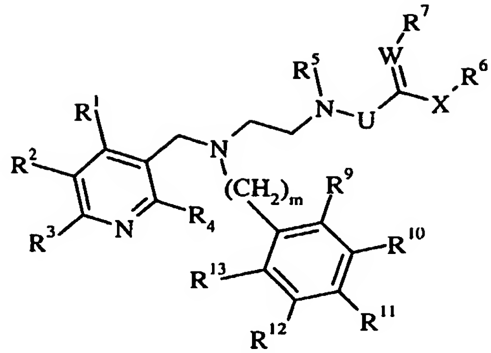
Cmpd No.	m	R^3	R^6	R^9	R^{10}	R^{11}	R^{12}	R^{13}	W	R^{33}
170	1	Br	CH_3	H	H	OCH_3	H	H	N	--
171	1	OCH_2CF_3	CH_3	H	H	OCH_3	H	H	N	--
172	1	OCH_2CF_3	CH_3	H	H	OCH_3	H	H	CR^{33}	H
173	1	Cl	[5]CH_3	H	H	Cl	H	H	CR^{33}	H
174	1	Cl	[5]CH_3	H	H	OCH_3	H	H	CR^{33}	H
175	1	Cl	CH_3	H	H	OCH_3	H	H	CR^{33}	[6]note

[1]a is 0; [2]X is NR^{36} where R^{36} is CH_3; [3]X is NR^{36} where R^{36} is hydrogen; [4]X is NR^{36} where R^{36} is C_2H_5; [5]X is oxygen; [6]R^{33} is 4-$(OCH_3)PhSCH_2$-

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R^3 is chloro; R is $-(CH_2)_m$-phenyl, wherein m is 1, phenyl is substituted with R^9 through R^{13}, inclusively; where R^9, R^{10}, R^{12} and R^{13} are hydrogen; and R^7 is C≡N:

Cmpd. No.	W	X	R^6	R^{11}	R^{34}	R^{35}
176	N	S	CH_3	Cl	--	--
177	N	S	CH_3	OCH_3	--	--
178	N	$CR^{34}R^{35}$	H	OCH_3	H	H
179	N	$CR^{34}R^{35}$	Cl	OCH_3	H	H
180	N	O	C_2H_5	OCH_3	--	--

where Ar is A; a is 1; b, c, e, r and s are 0; d is 1; R^a, R^b, R^c, R^d, R^1, R^2 and R^4 are hydrogen; R^3 is chloro; R is $-(CH_2)_m$-phenyl, wherein m is 1, phenyl is substituted with R^9 through R^{13}, inclusively; where R^9, R^{10}, R^{12} and R^{13} are hydrogen; and R^7 is C≡N:



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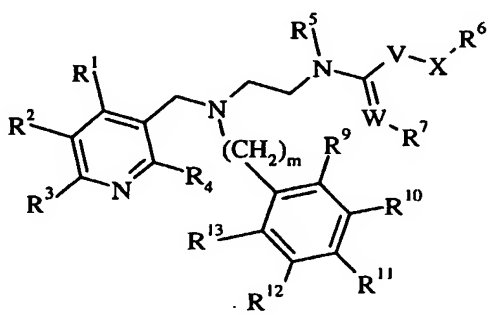
Cmpd. No.	U	W	X	R^5	R^6	R^{11}	R^{36}
181	CH_2	N	NR^{36}	H	C_2H_5	OCH_3	C_2H_5
182	CH_2	N	NR^{36}	CH_3	C_2H_5	OCH_3	C_2H_5

where Ar is A; a is 1; b, c, d, r and s are 0; e is 1; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R^3 is chloro; R is $-(CH_2)_m$-phenyl, wherein m is 1, phenyl is substituted with R^9 through R^{13}, inclusively; where R^9, R^{10}, R^{12} and R^{13} are hydrogen; and R^7 is C≡N:



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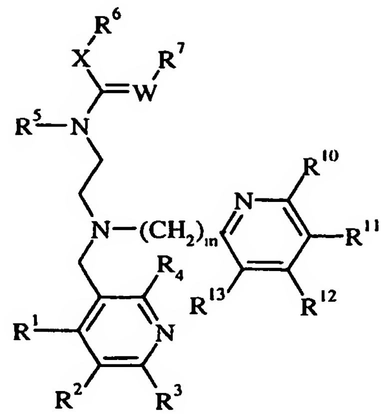
Cmpd. No.	V	W	X	R^6	R^{11}	R^{36}
183	CH_2	N	NR^{36}	C_2H_5	OCH_3	C_2H_5

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R is $-(CH_2)_m$-pyrid-2-yl, wherein pyrid-2-yl is substituted with R^{10} through R^{13}, inclusively; where R^{10}, R^{11}, R^{12}, and R^{13} are hydrogen; m is 1; and R^7 is NO_2:



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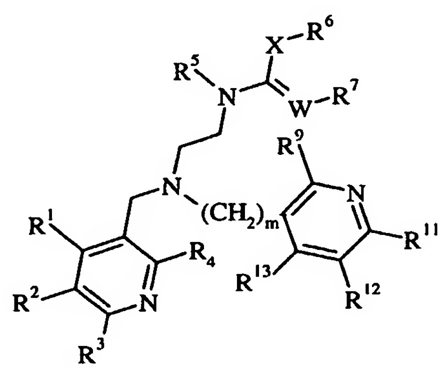
Cmpd. No.	R^3	X	R^6	W	R^{33}	R^{34}	R^{35}
184	Cl	S	CH_3	CR^{33}	H	--	--
185	Cl	S	CH_3	N	--	--	--
186	Cl	$CR^{34}R^{35}$	H	N	--	H	H

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, and R^4 are hydrogen; R is $-(CH_2)_m$-pyrid-3-yl, wherein pyrid-3-yl is substituted with R^9 and R^{11} through R^{13}, inclusively; where R^9, R^{12}, and R^{13} are hydrogen; and m is 1:



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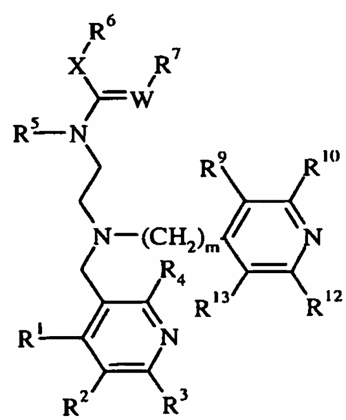
Cmpd. No.	R^3	R^5	X	R^6	R^7	R^{11}	W
187	Cl	H	O	CH_3	NO_2	Cl	$^2CR^{33}$
188	Cl	H	O	C_2H_5	NO_2	Cl	$^2CR^{33}$
189	Cl	H	O	$CH_2CH(CH_3)_2$	NO_2	Cl	$^2CR^{33}$
190	Cl	H	O	CH_2-c-hexyl	NO_2	Cl	$^2CR^{33}$
191	H	H	S	CH_3	NO_2	H	$^2CR^{33}$
192	Cl	H	S	CH_3	NO_2	H	$^2CR^{33}$
193	Br	H	S	CH_3	NO_2	H	$^2CR^{33}$
194	F	H	S	CH_3	NO_2	H	$^2CR^{33}$
195	CH_3	H	S	CH_3	NO_2	H	$^2CR^{33}$
196	CF_3	H	S	CH_3	NO_2	H	$^2CR^{33}$

Cmpd. No.	R^3	R^5	X	R^6	R^7	R^{11}	W
197	F	H	S	CH_3	NO_2	H	$^2CR^{33}$
198	Cl	H	S	CH_3	NO_2	Cl	$^2CR^{33}$
199	Cl	H	S	CH_3	NO_2	Cl	$^3CR^{33}$
200	Cl	$C_2H_4CH(CH_3)_2$	S	CH_3	NO_2	Cl	$^2CR^{33}$
201	Cl	H	S	C_2H_5	NO_2	Cl	$^2CR^{33}$
202	Cl	H	S	$CH_2CH(CH_3)_2$	NO_2	Cl	$^2CR^{33}$
203	Cl	H	S	CH_2-c-hexyl	NO_2	Cl	$^2CR^{33}$
204	Cl	H	S	$C_2H_4CH(F)=CF_2$	NO_2	Cl	$^2CR^{33}$
^{1}205	Cl	H	S	CH_3	NO_2	H	$^2CR^{33}$
206	Cl	H	$^4NR^{36}$	CH_3	NO_2	Cl	$^2CR^{33}$
207	Cl	H	$^4NR^{36}$	C_2H_5	NO_2	Cl	$^2CR^{33}$
208	Cl	H	$^4NR^{36}$	$C(CH_3)_3$	NO_2	Cl	$^2CR^{33}$
209	Cl	H	$^4NR^{36}$	OCH_3	NO_2	Cl	$^2CR^{33}$
210	Cl	H	$^4NR^{36}$	cyclopentyl	NO_2	Cl	$^2CR^{33}$
211	Cl	H	$^5NR^{36}$	CH_3	NO_2	Cl	$^2CR^{33}$
212	Cl	H	$^6NR^{36}$	C_2H_5	NO_2	Cl	$^2CR^{33}$
213	Cl	H	S	CH_3	$C\equiv N$	Cl	N
214	Cl	H	$^7CR^{34}R^{35}$	H	$C\equiv N$	Cl	N
215	Cl	H	$^7CR^{34}R^{35}$	H	NO_2	Cl	N
216	Cl	H	S	CH_3	NO_2	Cl	N

^{1}methyl iodide salt; $^2R^{33}$ is hydrogen; $^3R^{33}$ is CH_3; $^4R^{36}$ is hydrogen; $^5R^{36}$ is CH_3; $^6R^{36}$ is C_2H_5; $^7R^{34}$ and R^{35} are hydrogen.

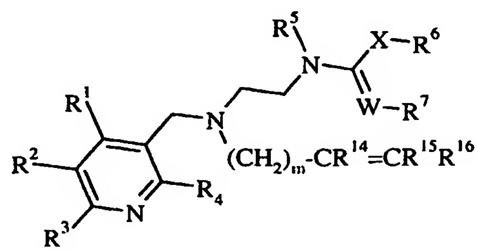
where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R is $-(CH_2)_m$-pyrid-4-yl, wherein pyrid-4-yl is substituted with R^9, R^{10}, R^{12} and R^{13}; where R^9, R^{10}, R^{12}, and R^{13} are hydrogen; m is 1; and R^7 is NO_2:



I

Cmpd No.	R^3	X	R^6	W	R^{33}
217	Cl	S	CH_3	CR^{33}	H
218	Cl	S	CH_3	N	--
219	Cl	CH_2	H	N	--

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R is $-(CH_2)_m-CR^{14}=CR^{15}R^{16}$; and R^7 is NO_2, unless otherwise noted:



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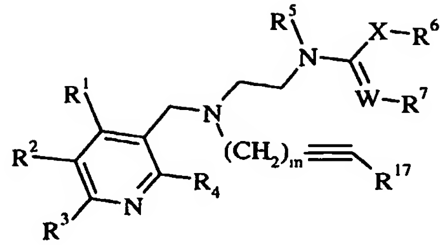
Cmpd. No.	R^3	W	X	R^6	m	R^{14}	R^{15}	R^{16}
220	Cl	$^1CR^{33}$	S	CH_3	1	H	H	H
221	Cl	$^1CR^{33}$	S	CH_2-c-hexyl	1	H	H	H
222	Cl	$^1CR^{33}$	S	CH_3	2	H	H	H
223	Cl	$^1CR^{33}$	S	CH_3	1	H	H	CH_3
224	Cl	$^1CR^{33}$	S	CH_3	1	H	H	Cl
225	Cl	$^1CR^{33}$	S	CH_3	1	Cl	H	H
226	Cl	$^1CR^{33}$	S	CH_3	1	Cl	H	*cis*-Cl
227	Cl	$^1CR^{33}$	S	CH_3	1	Cl	H	*trans*-Cl
228	Cl	$^1CR^{33}$	S	CH_3	1	H	Cl	Cl
229	Cl	$^1CR^{33}$	S	CH_3	2	F	F	F
230	Cl	$^1CR^{33}$	S	CH_3	1	H	H	Ph
231	Cl	N	S	CH_3	1	H	H	H
232	Cl	N	S	CH_2-c-hexyl	1	H	H	H
233	Cl	N	S	CH_3	2	H	H	H
234	Cl	N	S	CH_3	1	H	H	CH_3
235	Cl	N	S	CH_3	1	H	H	Cl
236	Cl	N	S	CH_3	1	Cl	H	H
237	Cl	N	S	CH_3	1	Cl	H	*cis*-Cl
238	Cl	N	S	CH_3	1	Cl	H	*trans*-Cl
239	Cl	N	S	CH_3	1	H	Cl	Cl
240	Cl	N	S	CH_3	2	F	F	F
241	Cl	N	S	CH_3	1	H	H	Ph
242	Cl	$^1CR^{33}$	O	CH_3	1	H	H	H
243	Cl	^2N	S	CH_3	1	H	H	H

$^1R^{33}$ is hydrogen; $^2R^7$ is C≡N

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2 and R^4 are hydrogen; R is $-(CH_2)_m-C{\equiv}CR^{17}$; and R^7 is NO_2 unless otherwise noted:



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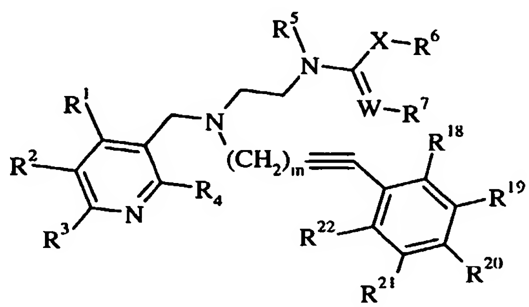
Cmpd. No.	R^3	W	X	R^5	R^6	m	R^{17}
244	Cl	$^1CR^{33}$	O	H	CH_3	1	H
245	Cl	$^1CR^{33}$	O	H	C_2H_5	1	H
246	Cl	$^1CR^{33}$	O	H	$C_2H_4OCH_3$	1	H
247	Cl	$^1CR^{33}$	O	H	$C_2H_4OC_2H_4OCH_3$	1	H
248	Cl	$^1CR^{33}$	S	H	CH_3	1	H
249	I	$^1CR^{33}$	S	H	CH_3	1	H
250	CH_3	$^1CR^{33}$	S	H	CH_3	1	H
251	CF_3	$^1CR^{33}$	S	H	CH_3	1	H
252	Cl	$^1CR^{33}$	S	H	CH_3	2	H
253	Cl	$^1CR^{33}$	S	H	CH_3	1	CH_3
254	Cl	$^1CR^{33}$	S	H	CH_3	2	CH_3
255	Cl	$^1CR^{33}$	S	H	CH_3	1	C_5H_{11}
256	Cl	$^1CR^{33}$	O	H	CH_2-c-hexyl	1	H
257	Cl	$^1CR^{33}$	S	H	CH_2-c-hexyl	1	H
258	Cl	$^1CR^{33}$	S	H	CH_2-c-hexyl	2	H
259	Cl	$^1CR^{33}$	S	CH_3	CH_3	1	H
260	Cl	$^1CR^{33}$	S	$C_2H_4CH(CH_3)_2$	CH_3	1	H
261	Cl	$^1CR^{33}$	$^2NR^{36}$	CH_3	CH_3	1	H
262	Cl	$^1CR^{33}$	$^3NR^{36}$	CH_3	CH_3	1	H
263	Cl	$^1CR^{33}$	$^4CR^{34}R^{35}$	H	H	1	H
264	Cl	$^1CR^{33}$	$^4CR^{34}R^{35}$	H	H	2	H
265	I	$^1CR^{33}$	$^4CR^{34}R^{35}$	H	H	1	H
266	CH_3	$^1CR^{33}$	$^4CR^{34}R^{35}$	H	H	1	H
267	CF_3	$^1CR^{33}$	$^4CR^{34}R^{35}$	H	H	1	H
268	Cl	$^1CR^{33}$	$^4CR^{34}R^{35}$	H	H	1	CH_3
269	Cl	$^1CR^{33}$	$^4CR^{34}R^{35}$	H	H	2	CH_3
270	Cl	$^1CR^{33}$	$^4CR^{34}R^{35}$	H	H	1	C_5H_{11}
271	Cl	$^1CR^{33}$	$^4CR^{34}R^{35}$	H	H	1	H
272	Cl	$^1CR^{33}$	$^4CR^{34}R^{35}$	CH_3	H	1	H
273	Cl	$^1CR^{33}$	$^4CR^{34}R^{35}$	$C_2H_4CH(CH_3)_2$	H	1	H
274	Cl	N	O	H	CH_3	1	H
275	F	N	O	H	CH_3	1	H
276	Cl	N	O	H	C_2H_5	1	H
277	Cl	N	O	H	$C_2H_4OCH_3$	1	H
278	Cl	N	O	H	$C_2H_4OC_2H_4OCH_3$	1	H
279	Cl	N	S	H	CH_3	1	H
280	I	N	S	H	CH_3	1	H
281	CH_3	N	S	H	CH_3	1	H
282	CF_3	N	S	H	CH_3	1	H
283	Cl	N	S	H	CH_3	2	H
284	Br	N	S	H	$CH(CH_3)_2$	1	H
285	Cl	N	S	H	CH_3	1	CH_3
286	Cl	N	S	H	CH_3	2	CH_3
287	Cl	N	S	H	CH_3	1	C_5H_{11}
288	Cl	N	O	H	CH_2-cyclohexyl	1	H

Cmpd. No.	R^3	W	X	R^5	R^6	m	R^{17}
289	Cl	N	S	H	CH_2-cyclohexyl	1	H
290	Cl	N	S	H	CH_2-cyclohexyl	2	H
291	Cl	N	S	CH_3	CH_3	1	H
292	Cl	N	S	$C_2H_4CH(CH_3)_2$	CH_3	1	H
293	F	N	$^2NR^{36}$	H	CH_3	1	H
294	Cl	N	$^2NR^{36}$	CH_3	CH_3	1	H
295	Cl	N	$^3NR^{36}$	CH_3	CH_3	1	H
296	CH_3	N	S	H	CH_3	1	H
297	Cl	$^1CR^{33}$	$^2NR^{36}$	H	CH_3	1	H
298	Cl	^5N	S	H	CH_3	1	H
299	Cl	^5N	$^2NR^{36}$	H	CH_3	1	H

$^1R^{33}$ is hydrogen; $^2R^{36}$ is hydrogen; $^3R^{36}$ is CH_3; $^4R^{34}$ and R^{35} are hydrogen; $^5R^7$ is C≡N

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R is $-(CH_2)_m$-C≡CR^{17}, wherein R^{17} is phenyl substituted with R^{18} through R^{22}, inclusively; where R^{18}, R^{19}, R^{21}, and R^{22} are hydrogen; and R^7 is NO_2:



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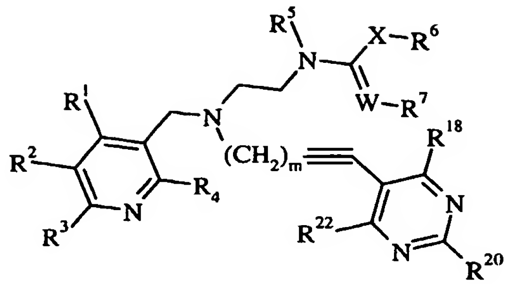
Cmpd. No.	R^3	m	W	X	R^6	R^{20}	R^{33}
300	Cl	1	CR^{33}	S	CH_3	H	H
301	Cl	2	CR^{33}	S	CH_3	Cl	H
302	Cl	1	CR^{33}	S	CH_3	F	H
303	Cl	1	CR^{33}	S	CH_3	CH_3	H

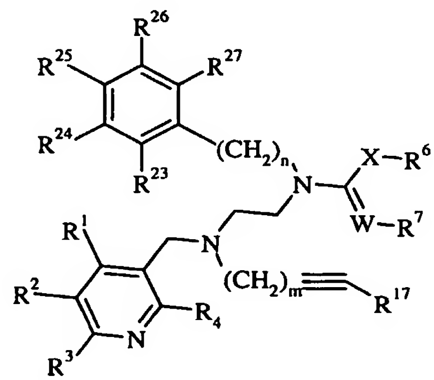
where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R is $-(CH_2)_m$-C≡CR^{17}, wherein R^{17} is pyrimidin-5-yl substituted with R^{18}, R^{20}, and R^{22} where R^{18}, R^{19}, R^{20}, and R^{22} are hydrogen; and R^7 is NO_2:



I

Cmpd. No.	R^3	m	W	X	R^6	R^{33}
304	Cl	1	CR^{33}	S	CH_3	H

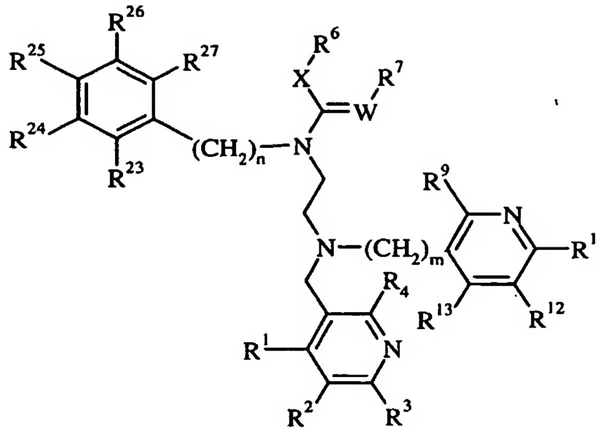
where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2 and R^4 are hydrogen; R is $-(CH_2)_m-C{\equiv}CR^{17}$; R^5 is $-(CH_2)_n$-phenyl where phenyl is substituted with R^{23} through R^{27}, inclusively, where R^{17}, R^{23}, R^{24}, R^{26}, and R^{27} are hydrogen; m and n are 1; and R^7 is NO_2:



I

Cmpd. No.	R^3	W	X	R^6	R^{25}	R^{33}
305	Cl	CR^{33}	S	CH_3	F	H

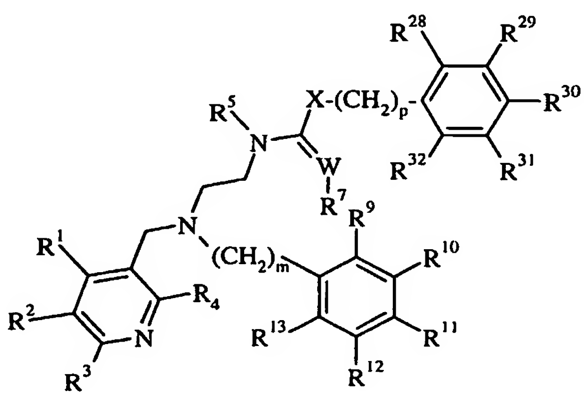
where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2 and R^4 are hydrogen; R is $-(CH_2)_m$-pyrid-3-yl, wherein pyrid-3-yl is substituted with R^9, and R^{11} through R^{13}, inclusively; R^5 is phenyl, wherein phenyl is substituted with R^{23} through R^{27}, inclusively; where R^9, R^{12}, R^{13}, R^{23}, R^{24}, R^{26} and R^{27} are hydrogen; m and n are 1; and R^7 is NO_2:



I

Cmpd. No.	R^3	W	X	R^6	R^{11}	R^{25}	R^{33}
306	Cl	CR^{33}	S	CH_3	Cl	F	H

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R is–$(CH_2)_m$-phenyl, wherein phenyl is substituted with R^9 through R^{13}, inclusively; R^6 is –$(CH_2)_p$-phenyl, wherein phenyl is substituted with R^{28} through R^{32}, inclusively, R^9, R^{10}, R^{12}, R^{13}, R^{28}, R^{29}, R^{31} and R^{32} are hydrogen; m is 1; and R^7 is NO_2:



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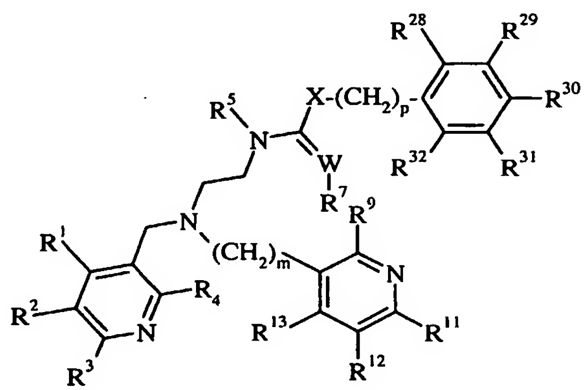
Cmpd. No.	R^3	X	W	R^{11}	p	R^{30}	R^{33}
307	Cl	S	CR^{33}	H	1	CF_3	H
308	Cl	S	N	OCH_3	0	OCH_3	--
309	4-(OCH_3)PhS	S	N	OCH_3	0	OCH_3	--
310	Cl	S	N	OCH_3	1	H	--
311	Cl	S	N	OCH_3	1	Cl	--
312	Cl	S	N	OCH_3	1	OCH_3	--
313	Cl	S	CR^{33}	OCH_3	0	OCH_3	4-(OCH_3)PhSCH_2-

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R is $-(CH_2)_m$-pyrid-3-yl, wherein pyrid-3-yl is substituted with R^9, and R^{11} through R^{13}, inclusively; R^6 is $-(CH_2)_p$-phenyl, wherein phenyl is substituted with R^{28} through R^{32}, inclusively; where R^9, R^{12}, and $R^{13}$are hydrogen; R^3 and R^{11} are chloro; m and p are 1; X is S; W is CR^{33} where R^{33} is hydrogen; and R^7 is NO_2:



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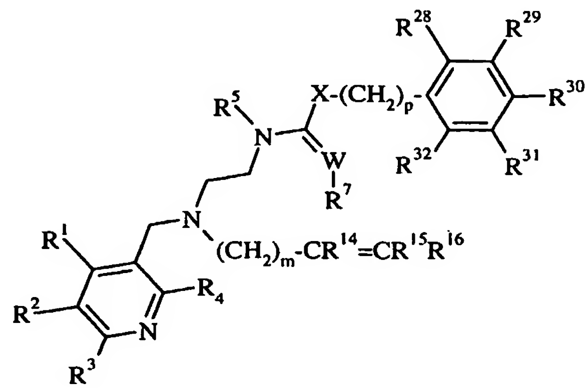
Cmpd. No.	R^{28}	R^{29}	R^{30}	R^{31}	R^{32}
314	Cl	H	H	H	H
315	H	Cl	H	H	H
316	H	H	Cl	H	H
317	H	H	F	H	H
318	F	F	F	F	F
319	CH_3	H	H	H	H
320	H	CH_3	H	H	H
321	H	H	CH_3	H	H
322	CF_3	H	H	H	H
323	H	CF_3	H	H	H
324	H	H	CF_3	H	H
325	OCH_3	H	H	H	H
326	H	OCH_3	H	H	H
327	H	H	OCH_3	H	H

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R is $-(CH_2)_m-CR^{14}=CR^{15}R^{16}$; R^6 is $-(CH_2)_p$-phenyl, wherein phenyl is substituted with R^{28} through R^{32}, inclusively; where R^{14}, R^{15}, R^{16}, R^{28}, R^{29}, R^{31}, and R^{32} are hydrogen; m and p are 1; and R^7 is NO_2:



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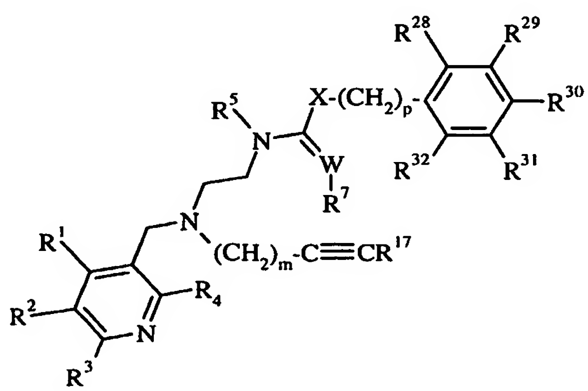
Cmpd. No.	R^3	W	X	R^{30}	R^{33}
328	Cl	CR^{33}	S	CF_3	H

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 and R^5 are hydrogen; R is $-(CH_2)_m-C\equiv CR^{17}$; R^6 is $-(CH_2)_p$-phenyl, wherein phenyl is substituted with R^{28} through R^{32}, inclusively; where R^{17}, R^{28}, R^{29}, R^{31}, and R^{32} are hydrogen; m and p are 1; and R^7 is NO_2:



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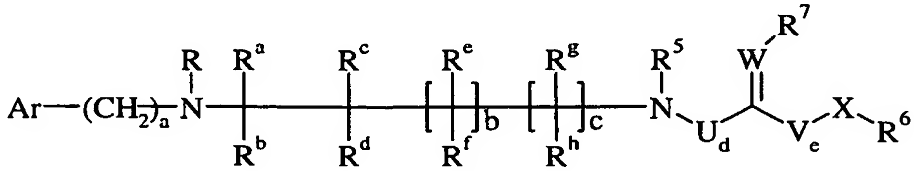
Cmpd. No.	R^3	W	X	m	R^{30}	R^{33}
329	Cl	CR^{33}	S	1	CF_3	H
330	Cl	CR^{33}	S	2	CF_3	H

where a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^5, R^9, R^{10}, R^{12}, R^{13}, R^{14}, R^{15}, R^{16}, R^{17}, R^{28}, R^{29}, R^{30}, R^{31} and R^{32} are hydrogen; m and p are 1; X is -S-; and when W is CR^{33}, R^{33} is hydrogen:



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Cmpd. No.	Ar	R	R^{11}	W	R^6	R^7
331	B^1	$(CH_2)_m$-Phenyl where phenyl is substituted with R^9-R^{13} as shown above	Cl	CR^{33}	CH_3	NO_2
332	B	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2
333	B	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
334	B	$(CH_2)_m$-3-pyridyl where pyridyl is substituted with R^9 and R^{11}-R^{13} as shown above	H	CR^{33}	CH_3	NO_2
335	B	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
336	B	$-(CH_2)_m-C\equiv CR^{17}$	----	CR^{33}	CH_3	NO_2
337	B	Same as Cmpd 331	Cl	N	CH_3	NO_2
338	B	Same as Cmpd 331	CH_3	N	CH_3	NO_2
339	B	Same as Cmpd 331	OCH_3	N	CH_3	NO_2
340	B	Same as Cmpd 334	H	N	CH_3	NO_2
341	B	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	CH_3	NO_2
342	B	$-(CH_2)_m-C\equiv CR^{17}$	----	N	CH_3	NO_2
343	B	Same as Cmpd 331	Cl	N	CH_3	$C\equiv N$
344	B	Same as Cmpd 331	CH_3	N	CH_3	$C\equiv N$
345	B	Same as Cmpd 331	OCH_3	N	CH_3	$C\equiv N$
346	B	Same as Cmpd 334	H	N	CH_3	$C\equiv N$
347	B	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	CH_3	$C\equiv N$

Cmpd. No.	Ar	R	R^{11}	W	R^6	R^7
348	B	$-(CH_2)_m-C{\equiv}CR^{17}$	----	N	CH_3	C≡N
349	B	Same as Cmpd 331	Cl	N	$CH(CH_3)_2$	NO_2
350	B	Same as Cmpd 331	CH_3	N	$CH(CH_3)_2$	NO_2
351	B	Same as Cmpd 331	OCH_3	N	$CH(CH_3)_2$	NO_2
352	B	Same as Cmpd 334	H	N	$CH(CH_3)_2$	NO_2
353	B	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	$CH(CH_3)_2$	NO_2
354	B	$-(CH_2)_m-C{\equiv}CR^{17}$	----	N	$CH(CH_3)_2$	NO_2
355	B	Same as Cmpd 331	Cl	N	$CH_2CH=CH_2$	NO_2
356	B	Same as Cmpd 331	CH_3	N	$CH_2CH=CH_2$	NO_2
357	B	Same as Cmpd 331	OCH_3	N	$CH_2CH=CH_2$	NO_2
358	B	Same as Cmpd 334	H	N	$CH_2CH=CH_2$	NO_2
359	B	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	$CH_2CH=CH_2$	NO_2
360	B	$-(CH_2)_m-C{\equiv}CR^{17}$	----	N	$CH_2CH=CH_2$	NO_2
361	B	Same as Cmpd 331	Cl	N	$(CH_2)_p$-Phenyl where phenyl is substituted with R^{28}-R^{32} as shown above	NO_2
362	B	Same as Cmpd 331	CH_3	N	Same as Cmpd 361	NO_2
363	B	Same as Cmpd 331	OCH_3	N	Same as Cmpd 361	NO_2
364	B	Same as Cmpd 334	H	N	Same as Cmpd 361	NO_2
365	B	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	Same as Cmpd 361	NO_2
366	B	$-(CH_2)_m-C{\equiv}CR^{17}$	----	N	Same as Cmpd 361	NO_2
367	C	Same as Cmpd 331	Cl	CR^{33}	CH_3	NO_2
368	C	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2
369	C	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
370	C	Same as Cmpd 334	H	CR^{33}	CH_3	NO_2
371	C	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
372	C	$-(CH_2)_m-C{\equiv}CR^{17}$	----	CR^{33}	CH_3	NO_2
373	C	Same as Cmpd 331	Cl	N	Same as Cmpd 361	NO_2
374	C	Same as Cmpd 331	CH_3	N	Same as Cmpd 361	NO_2

Cmpd. No.	Ar	R	R^{11}	W	R^6	R^7
375	C	Same as Cmpd 331	OCH_3	N	Same as Cmpd 361	NO_2
376	C	Same as Cmpd 334	H	N	Same as Cmpd 361	NO_2
377	C	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	Same as Cmpd 361	NO_2
378	C	$-(CH_2)_m-C\equiv CR^{17}$	----	N	Same as Cmpd 361	NO_2
379	D	Same as Cmpd 331	Cl	CR^{33}	CH_3	NO_2
380	D	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2
381	D	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
382	D	Same as Cmpd 334	H	CR^{33}	CH_3	NO_2
383	D	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
384	D	$-(CH_2)_m-C\equiv CR^{17}$	----	CR^{33}	CH_3	NO_2
385	D	Same as Cmpd 331	Cl	N	Same as Cmpd 361	NO_2
386	D	Same as Cmpd 331	CH_3	N	Same as Cmpd 361	NO_2
387	D	Same as Cmpd 331	OCH_3	N	Same as Cmpd 361	NO_2
388	D	Same as Cmpd 334	H	N	Same as Cmpd 361	NO_2
389	D	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	Same as Cmpd 361	NO_2
390	D	$-(CH_2)_m-C\equiv CR^{17}$	----	N	Same as Cmpd 361	NO_2
391	E	Same as Cmpd 331	Cl	CR^{33}	CH_3	NO_2
392	E	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2
393	E	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
394	E	Same as Cmpd 334	H	CR^{33}	CH_3	NO_2
395	E	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
396	E	$-(CH_2)_m-C\equiv CR^{17}$	----	CR^{33}	CH_3	NO_2
397	E	Same as Cmpd 331	Cl	CR^{33}	CH_3	NO_2
398	E	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2
399	E	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
400	E	Same as Cmpd 334	H	CR^{33}	CH_3	NO_2
401	E	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
402	E	$-(CH_2)_m-C\equiv CR^{17}$	----	CR^{33}	CH_3	NO_2

Cmpd. No.	Ar	R	R^{11}	W	R^6	R^7
403	E	Same as Cmpd 331	Cl	N	Same as Cmpd 361	NO_2
404	E	Same as Cmpd 331	CH_3	N	Same as Cmpd 361	NO_2
405	E	Same as Cmpd 331	OCH_3	N	Same as Cmpd 361	NO_2
406	E	Same as Cmpd 334	H	N	Same as Cmpd 361	NO_2
407	E	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	Same as Cmpd 361	NO_2
408	E	$-(CH_2)_m-C\equiv CR^{17}$	----	N	Same as Cmpd 361	NO_2
409	F	Same as Cmpd 331	Cl	CR^{33}	CH_3	NO_2
410	F	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2
411	F	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
412	F	Same as Cmpd 334	H	CR^{33}	CH_3	NO_2
413	F	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
414	F	$-(CH_2)_m-C\equiv CR^{17}$	----	CR^{33}	CH_3	NO_2
415	F	Same as Cmpd 331	Cl	N	Same as Cmpd 361	NO_2
416	F	Same as Cmpd 331	CH_3	N	Same as Cmpd 361	NO_2
417	F	Same as Cmpd 331	OCH_3	N	Same as Cmpd 361	NO_2
418	F	Same as Cmpd 334	H	N	Same as Cmpd 361	NO_2
419	F	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	Same as Cmpd 361	NO_2
420	F	$-(CH_2)_m-C\equiv CR^{17}$	----	N	Same as Cmpd 361	NO_2
421	G	Same as Cmpd 331	Cl	CR^{33}	CH_3	NO_2
422	G	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2
423	G	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
424	G	Same as Cmpd 334	H	CR^{33}	CH_3	NO_2
425	G	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
426	G	$-(CH_2)_m-C\equiv CR^{17}$	----	CR^{33}	CH_3	NO_2
427	G	Same as Cmpd 331	Cl	N	Same as Cmpd 361	NO_2
428	G	Same as Cmpd 331	CH_3	N	Same as Cmpd 361	NO_2
429	G	Same as Cmpd 331	OCH_3	N	Same as Cmpd 361	NO_2

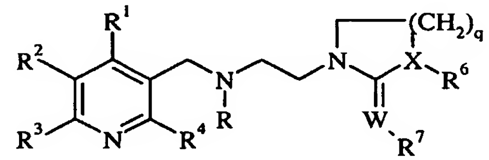
Cmpd. No.	Ar	R	R^{11}	W	R^6	R^7
430	G	Same as Cmpd 334	H	N	Same as Cmpd 361	NO_2
431	G	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	Same as Cmpd 361	NO_2
432	G	$-(CH_2)_m-C\equiv CR^{17}$	----	N	Same as Cmpd 361	NO_2
433	H	Same as Cmpd 331	Cl	CR^{33}	CH_3	NO_2
434	H	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2
435	H	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
436	H	Same as Cmpd 334	H	CR^{33}	CH_3	NO_2
437	H	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
438	H	$-(CH_2)_m-C\equiv CR^{17}$	----	CR^{33}	CH_3	NO_2
439	H	Same as Cmpd 331	Cl	N	Same as Cmpd 361	NO_2
440	H	Same as Cmpd 331	CH_3	N	Same as Cmpd 361	NO_2
441	H	Same as Cmpd 331	OCH_3	N	Same as Cmpd 361	NO_2
442	H	Same as Cmpd 334	H	N	Same as Cmpd 361	NO_2
443	H	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	Same as Cmpd 361	NO_2
444	H	$-(CH_2)_m-C\equiv CR^{17}$	----	N	Same as Cmpd 361	NO_2
445	J	Same as Cmpd 331	Cl	CR^{33}	CH_3	NO_2
446	J	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2
447	J	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
448	J	Same as Cmpd 334	H	CR^{33}	CH_3	NO_2
449	J	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
450	J	$-(CH_2)_m-C\equiv CR^{17}$	----	CR^{33}	CH_3	NO_2
451	J	Same as Cmpd 331	Cl	N	Same as Cmpd 361	NO_2
452	J	Same as Cmpd 331	CH_3	N	Same as Cmpd 361	NO_2
453	J	Same as Cmpd 331	OCH_3	N	Same as Cmpd 361	NO_2
454	J	Same as Cmpd 334	H	N	Same as Cmpd 361	NO_2
455	J	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	Same as Cmpd 361	NO_2
456	J	$-(CH_2)_m-C\equiv CR^{17}$	----	N	Same as Cmpd 361	NO_2
457	K	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2

Cmpd. No.	Ar	R	R^{11}	W	R^6	R^7
458	K	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
459	K	Same as Cmpd 334	H	CR^{33}	CH_3	NO_2
460	K	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
461	K	$-(CH_2)_m-C\equiv CR^{17}$	----	CR^{33}	CH_3	NO_2
462	K	Same as Cmpd 331	Cl	N	Same as Cmpd 361	NO_2
463	K	Same as Cmpd 331	CH_3	N	Same as Cmpd 361	NO_2
464	K	Same as Cmpd 331	OCH_3	N	Same as Cmpd 361	NO_2
465	K	Same as Cmpd 334	H	N	Same as Cmpd 361	NO_2
466	K	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	N	Same as Cmpd 361	NO_2
467	K	$-(CH_2)_m-C\equiv CR^{17}$	----	N	Same as Cmpd 361	NO_2
468	L	Same as Cmpd 331	Cl	CR^{33}	CH_3	NO_2
469	L	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2
470	L	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
471	L	Same as Cmpd 334	H	CR^{33}	CH_3	NO_2
472	L	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
473	L	$-(CH_2)_m-C\equiv CR^{17}$	----	CH	CH_3	NO_2
474	L	Same as Cmpd 331	Cl	N	Same as Cmpd 361	NO_2
475	L	Same as Cmpd 331	CH_3	N	Same as Cmpd 361	NO_2
476	L	Same as Cmpd 331	OCH_3	N	Same as Cmpd 361	NO_2
477	M	Same as Cmpd 331	Cl	CR^{33}	CH_3	NO_2
478	M	Same as Cmpd 331	CH_3	CR^{33}	CH_3	NO_2
479	M	Same as Cmpd 331	OCH_3	CR^{33}	CH_3	NO_2
480	M	Same as Cmpd 334	H	CR^{33}	CH_3	NO_2
481	M	$-(CH_2)_m-CR^{14}=CR^{15}R^{16}$	----	CR^{33}	CH_3	NO_2
482	M	$-(CH_2)_m-C\equiv CR^{17}$	----	CR^{33}	CH_3	NO_2
483	M	Same as Cmpd 331	Cl	N	Same as Cmpd 361	NO_2
484	M	Same as Cmpd 331	CH_3	N	Same as Cmpd 361	NO_2
485	M	Same as Cmpd 331	OCH_3	N	Same as Cmpd 361	NO_2

Cmpd. No.	Ar	R	R^{11}	W	R^6	R^7
486	M	Same as Cmpd 331	OCH_3	N	CH_3	NO_2

[1]when Ar is B, R^3 is chloro

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, and R^4 are hydrogen; R^3 is chloro; and R^5 and X are taken together with $-CH_2(CH_2)_q$- to form a ring, and R^7 is NO_2:



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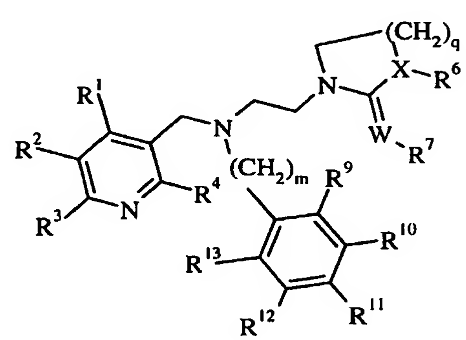
Cmpd. No.	R	q	W	X	R^6	R^{33}	R^{34}
487	$C_2H_4OCH_3$	1	CR^{33}	CR^{34}	CH_3	H	H
488	n-C_3H_7	1	N	N	H	--	--
489	$C_2H_4OCH_3$	1	N	N	$CH(CH_3)_2$	--	--
490	$C_2H_4OCH_3$	2	CR^{33}	S	----	H	--
491	cyclohex-1-en-3-yl	2	CR^{33}	S	----	H	--
492	H	1	CR^{33}	N	H	H	--
493	CH_2CN	1	CR^{33}	N	H	H	--
494	H	1	N	N	H	--	--
495	CH_2CN	1	N	N	H	--	--

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, R^4 are hydrogen; R is $-(CH_2)_m$-phenyl, wherein phenyl is substituted with R^9 through R^{13}, inclusively; where R^{13} is hydrogen; R^3 is chloro; m is 1; R^5 and X are taken together with $-CH_2(CH_2)_q$- to form a ring, and R^7 is NO_2:



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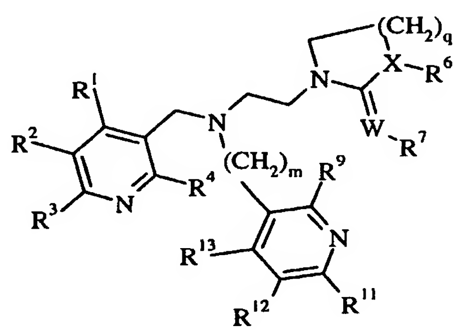
Cmpd No.	W	X	q	R^6	R^9	R^{10}	R^{11}	R^{12}	R^{33}
496	CR^{33}	N	1	H	H	H	OCH_3	H	H
497	N	N	1	H	H	H	Cl	H	--
498	N	N	1	H	H	H	OCH_3	H	--
499	CR^{33}	N	1	H	H	H	Cl	H	H
500	CR^{33}	S	2	----	H	H	Cl	H	H
501	CR^{33}	N	1	H	Cl	H	H	H	H
502	CR^{33}	S	2	----	H	H	CH_3	H	H
503	CR^{33}	S	2	----	H	H	OCH_3	H	H
504	CR^{33}	N	1	H	H	OCH_3	H	OCH_3	H

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, and R^4 are hydrogen; R is $-(CH_2)_m$-pyrid-3-yl, wherein pyrid-3-yl is substituted with R^9, and R^{11} through R^{13}, inclusively; where R^9, R^{11}, R^{12} and R^{13} are hydrogen; m is 1; R^5 and X are taken together with $-CH_2(CH_2)_q$- to form a ring:



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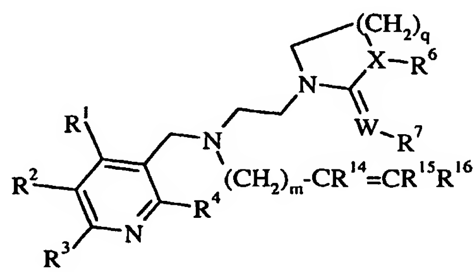
Cmpd No.	W	R^3	X	q	R^6	R^7	R^{33}	R^{34}
505	CR^{33}	Cl	CR^{34}	1	CH_3	NO_2	H	H
506	N	Cl	CR^{34}	1	CH_3	NO_2	--	H
507	N	Cl	CR^{34}	1	$CH(CH_3)_2$	C≡N	--	H
508	N	F	CR^{34}	1	$CH(CH_3)_2$	NO_2	--	H
509	CR^{33}	Cl	N	1	$CH(CH_3)_2$	NO_2	H	--
510	CR^{33}	Cl	S	2	--	NO_2	H	--
511	N	Cl	S	2	--	NO_2	--	--
512	N	Cl	S	2	--	C≡N	--	--
513	N	Cl	O	2	--	NO_2	--	--
514	N	Cl	S	3	--	NO_2	--	--
515	N	Cl	O	3	--	NO_2	--	--

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, and R^4 are hydrogen; R is $-(CH_2)_m-CR^{14}=CR^{15}R^{16}$, where R^{14}, R^{15}, and R^{16} are hydrogen; m is 1; R^5 and X are taken together with $-CH_2(CH_2)_q-$ to form a ring; and R^7 is NO_2:



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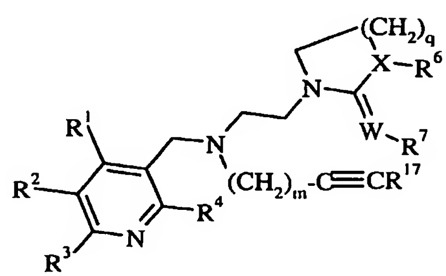
Cmpd. No.	R^3	q	W	X	R^6	R^{33}	R^{34}
516	Cl	1	CR^{33}	CR^{34}	H	H	H
517	Cl	1	CR^{33}	N	$CH(CH_3)_2$	H	--
518	Cl	2	CR^{33}	CR^{34}	H	H	H
519	Cl	1	CR^{33}	N	H	H	--
520	Cl	1	N	N	H	--	--

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, and R^4 are hydrogen; R^3 is chlorine; R is $-(CH_2)_m-C\equiv CR^{17}$; m is 1; and R^5 and X are taken together with $-CH_2(CH_2)_q-$ to form a ring:



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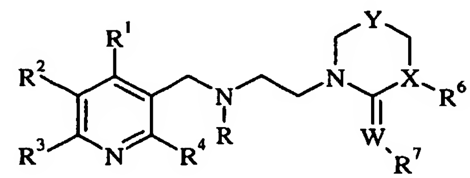
Cmpd. No.	q	W	X	R^6	R^7	R^{17}	R^{33}	R^{34}
521	1	CR^{33}	CR^{34}	CH_3	NO_2	H	H	H
522	1	CR^{33}	N	$CH(CH_3)_2$	$C\equiv N$	H	H	--
523	2	CR^{33}	S	----	NO_2	H	H	--
524	1	N	N	H	NO_2	H	--	--
525	1	CR^{33}	N	H	NO_2	H	H	--
526	1	CR^{33}	N	N	NO_2	CH_3	H	--

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, and R^4 are hydrogen; R^5 and X are taken together with $-CH_2YCH_2-$ to form a ring; and R^7 is NO_2:



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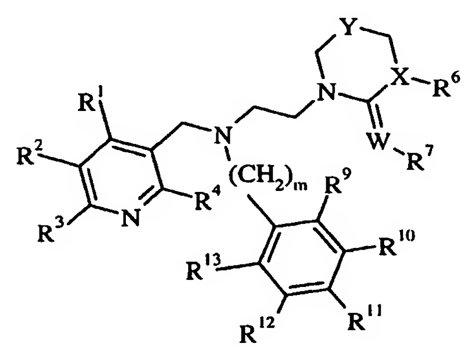
Cmpd. No.	R	R^3	W	X	Y	R^6	R^{37}
527	CH_3	Cl	N	N	O	H	--
528	CH_3	Cl	N	N	O	CH_3	--
529	CH_3	Cl	N	N	S	H	--
530	CH_3	Cl	N	N	S	CH_3	--
531	CH_3	Cl	N	N	NR^{37}	H	CH_3
532	CH_3	Cl	N	N	NR^{37}	CH_3	CH_3
533	$C_2H_4OCH_3$	Cl	N	N	O	CH_3	--
534	$CH_2C{\equiv}N$	Cl	N	N	O	H	--
535	$CH_2C{\equiv}N$	Cl	N	N	O	CH_3	--
536	$CH_2C{\equiv}N$	Cl	N	N	S	H	--
537	$CH_2C{\equiv}N$	Cl	N	N	S	CH_3	--
538	$CH_2C{\equiv}N$	Cl	N	N	NR^{37}	H	CH_3
539	$CH_2C{\equiv}N$	Cl	N	N	NR^{37}	CH_3	CH_3

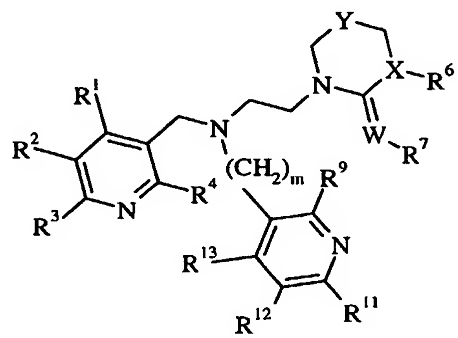
where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2 and R^4 are hydrogen; R is $-(CH_2)_m$-phenyl, wherein phenyl is substituted with R^9 through R^{13}, inclusively, where R^9, R^{10}, R^{12} and R^{13} are hydrogen; m is 1; R^5 and X are taken together with $-CH_2YCH_2-$ to form a ring, and R^7 is NO_2:



I

Cmpd No	R^3	W	X	Y	R^6	R^{11}	R^{37}
540	Cl	N	N	O	CH_3	Cl	--
541	Cl	N	N	O	$CH(CH_3)_2$	Cl	--
542	Cl	N	N	O	H	CH_3	--
543	Cl	N	N	O	CH_3	CH_3	--
544	Cl	N	N	O	H	OCH_3	--
545	Cl	N	N	O	CH_3	OCH_3	--
546	Cl	N	N	NR^{37}	CH_3	OCH_3	CH_3

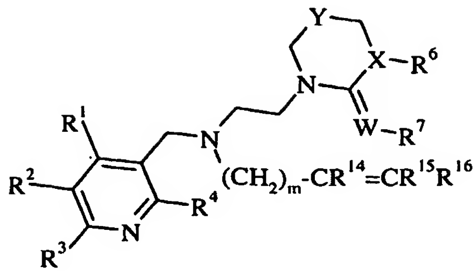
where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2, and R^4 are hydrogen; R is $-(CH_2)_m$-pyrid-3-yl, wherein pyrid-3-yl is substituted with R^9, and R^{11} through R^{13}, inclusively; where R^9, R^{12} and R^{13} are hydrogen; m is 1; R^5 and X are taken together with $-CH_2YCH_2$- to form a ring, and R^7 is NO_2:



I

Cmpd. No.	R^3	W	X	Y	R^6	R^{11}
547	Cl	N	N	O	H	Cl
548	Cl	N	N	O	CH_3	Cl

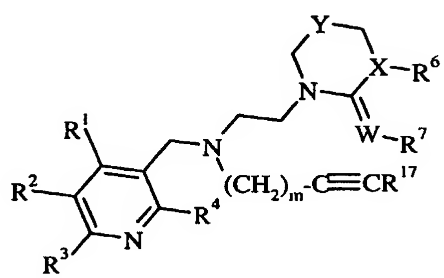
where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2 and R^4 are hydrogen; R is $-(CH_2)_m-CR^{14}=CR^{15}R^{16}$, where R^{14}, R^{15}, and R^{16} are hydrogen; m is 1; R^5 and X are taken together with $-CH_2YCH_2$- to form a ring; and R^7 is NO_2:



I

Cmpd No.	R^3	W	X	Y	R^6
549	H	CH	S	O	----
550	Cl	CH	S	O	----
551	Br	CH	S	O	----
552	F	CH	S	O	----
553	CH_3	CH	S	O	----
554	OCH_3	CH	S	O	----
555	Cl	N	N	O	H
556	Cl	N	N	O	CH_3

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2 and R^4 are hydrogen; R is $-(CH_2)_m-C{\equiv}CR^{17}$, where R^{17} is hydrogen; m is 1; R^5 and X are taken together with $-CH_2YCH_2-$ to form a ring, and R^7 is NO_2:



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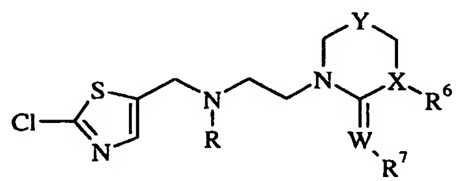
Cmpd. No.	R^3	W	X	Y	R^6	R^{37}
557	Cl	N	O	O	----	----
558	Cl	N	N	O	H	----
559	Cl	N	N	S	H	----
560	Cl	N	N	S	CH_3	----
561	Cl	N	N	NR^{37}	H	CH_3
562	Cl	N	N	NR^{37}	CH_3	CH_3

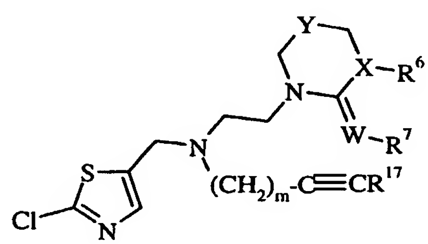
where Ar is B and R^3 is chloro; a is 1; b, c, d, e and r are 0; R^a, R^b, R^c, and R^d are hydrogen; R^5 and X are taken together with $-CH_2YCH_2-$ to form a ring, and R^7 is NO_2:



I

Cmpd. No.	R	W	X	Y	R^6
563	CH_3	N	N	O	H
564	CH_3	N	N	O	CH_3
565	$CH_2C{\equiv}N$	N	N	O	H
566	$CH_2C{\equiv}N$	N	N	O	CH_3
567	2-Cl-1,3-thiazol-5-ylmethyl	N	N	O	H
568	2-Cl-1,3-thiazol-5-ylmethyl	N	N	O	CH_3

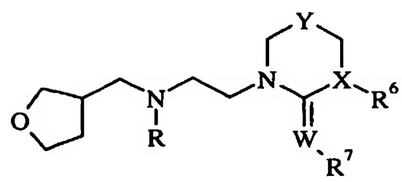
where Ar is B and R^3 is chloro; a is 1; b, c, d, e and r are 0; R^a, R^b, R^c, and R^d are hydrogen; R is $-(CH_2)_m-C{\equiv}CR^{17}$, where R^{17} is hydrogen; m is 1; R^5 and X are taken together with $-CH_2YCH_2-$ to form a ring, and R^7 is NO_2:



I

Cmpd No.	W	X	Y	R^6
569	N	N	O	H
570	N	N	O	CH_3

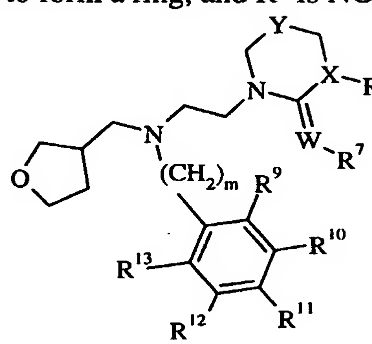
where Ar is M; a is 1; b, c, d, e and r are 0; R^a, R^b, R^c, and R^d are hydrogen; R^5 and X are taken together with $-CH_2YCH_2-$ to form a ring, and R^7 is NO_2:



I

Cmpd. No.	R	W	X	Y	R^6
571	oxolan-3-ylmethyl	N	N	O	H
572	oxolan-3-ylmethyl	N	N	O	CH_3

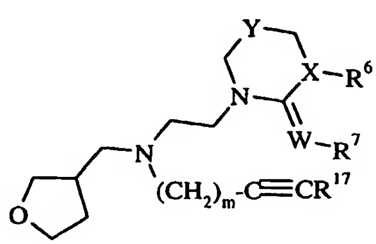
where Ar is M; a is 1; b, c, d, e and r are 0; R^a, R^b, R^c and R^d are hydrogen; R is $-(CH_2)_m$-phenyl, wherein phenyl is substituted with R^9 through R^{13}, inclusively, where R^9, R^{10}, R^{12} and R^{13} are hydrogen; m is 1; and R^5 and X are taken together with $-CH_2YCH_2$- to form a ring, and R^7 is NO_2:



I

Cmpd No	W	X	Y	R^6	R^{11}
573	N	N	O	H	OCH_3
574	N	N	O	CH_3	OCH_3

where Ar is M; a is 1; b, c, d, e and r are 0; R^a, R^b, R^c, and R^d are hydrogen; R is $-(CH_2)_m$-C≡CR^{17}, where R^{17} is hydrogen; m is 1; R^5 and X are taken together with $-CH_2YCH_2$- to form a ring, and R^7 is NO_2:



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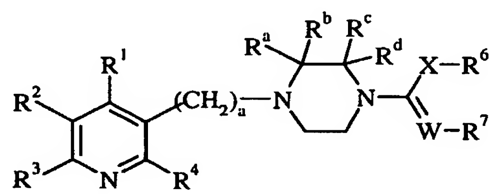
Cmpd. No.	W	X	Y	R^6
575	N	N	O	H
576	N	N	O	CH_3

where Ar is A; a is 1; b, c, d, e, r and s are 0; R^a, R^b, R^c, R^d, R^1, R^2 and R^4 are hydrogen; R^3 is chloro; and R and R^5 are taken with $-CH_2CH_2-$ to form a piperazine ring:



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Cmpd. No.	X	R^6	W	R^7	R^{33}
577	S	CH_3	N	C≡N	--
578	S	CH_3	N	NO_2	--
579	S	CH_3	CR^{33}	NO_2	H

The following table sets forth physical characterizing data for certain compounds of formula **I** of the present invention:

Table 2
Insecticidal N-(Heteroarylalkyl)alkanediamine Derivatives
Compound Characterization

	Molecular Formula	Melting Point (°C) of Solids Or Physical State
1	$C_{14}H_{20}ClFN_4O_3$	64-65
2	$C_{14}H_{20}ClFN_4O_2S$	79-80
3	$C_{14}H_{18}ClF_3N_4O_2S$	SYRUP
4	$C_{14}H_{21}ClN_4O_3S$	OIL
5	$C_{15}H_{23}ClN_4O_3S$	OIL
6	$C_{16}H_{25}ClN_4O_5$	LIQUID
7	$C_{16}H_{25}ClN_4O_4S$	LIQUID
8	$C_{18}H_{29}ClN_4O_6$	LIQUID
9	$C_{11}H_{15}ClN_4O_3S$	SOLID

	Molecular Formula	Melting Point (°C) of Solids Or Physical State
10	$C_{13}H_{16}ClN_5O_2S$	142
11	$C_{13}H_{17}ClN_4O_3S$	OIL
12	$C_{12}H_{17}ClN_4O_4S_2$	63-66
13	$C_{15}H_{24}ClN_4O_5PS$	OIL
14	$C_{16}H_{23}ClN_4O_3S$	SYRUP
15	$C_{17}H_{25}ClN_4O_3S$	OIL
16	$C_{17}H_{23}ClN_4O_2S$	OIL
17	$C_{16}H_{19}ClN_4O_2S_2$	SYRUP
18	$C_{16}H_{19}ClN_4O_3S$	102-104
19	$C_{16}H_{19}ClN_4O_3S$	SYRUP
20	$C_{20}H_{21}ClN_4O_3S$	OIL
38	$C_{12}H_{15}ClN_4O_3S$	85-90
39	$C_{16}H_{23}ClN_4O_4S$	SYRUP
40	$C_{14}H_{19}ClN_4O_3$	OIL
41	$C_{13}H_{19}ClN_4O_3$	OIL
42	$C_{13}H_{20}ClN_5O_2$	SOLID
43	$C_{13}H_{17}ClN_6O_2$	156-158
44	$C_{12}H_{18}ClN_5O_2$	SYRUP
46	$C_{13}H_{19}ClFN_5O_2S$	OIL
51	$C_{15}H_{24}ClN_5O_4S$	OIL
54	$C_{12}H_{15}ClN_6O_2S$	SOLID
65	$C_{12}H_{18}ClN_5O_2S$	--
66	$C_{13}H_{20}ClN_5O_2S$	OIL
67	$C_{14}H_{22}ClN_5O_2S$	OIL
68	$C_{14}H_{20}ClN_5O_2S$	OIL
69	$C_{15}H_{22}ClN_5O_2S$	OIL
70	$C_{17}H_{26}ClN_5O_2S$	OIL
71	$C_{12}H_{17}ClFN_5O_2S$	OIL
72	$C_{11}H_{14}ClN_5O_3S$	FOAM
73	$C_{15}H_{22}ClN_5O_4S$	SYRUP
74	$C_{10}H_{15}ClN_6O_2$	SYRUP
75	$C_{15}H_{23}ClN_6O_4$	46-49
96	$C_{14}H_{20}ClN_5S$	OIL
97	$C_{12}H_{14}ClN_5OS$	49-53
98	$C_{16}H_{22}ClN_5O_2S$	SYRUP
99	$C_{16}H_{23}ClN_6O_2$	55-69
100	$C_{15}H_{17}Cl_2N_5O_2S_2$	124
101	$C_{16}H_{20}ClN_5O_2S_2$	112-114
102	$C_{21}H_{21}Cl_2N_5O_2S_2$	50-55
103	$C_{21}H_{23}ClN_6O_4S$	110-112
104	$C_{21}H_{23}ClN_6O_4S$	SYRUP
105	$C_{21}H_{23}ClN_6O_4S$	SYRUP
106	$C_{21}H_{20}ClF_3N_6O_3S$	137-138
197	$C_{19}H_{22}ClN_7O_4S$	SYRUP
108	$C_{18}H_{21}ClN_4O_2S$	OIL
109	$C_{20}H_{25}ClN_4O_2S$	OIL
110	$C_{18}H_{20}Cl_2N_4O_2S$	OIL

	Molecular Formula	Melting Point (°C) of Solids Or Physical State
111	$C_{18}H_{20}Cl_2N_4O_2S$	OIL
112	$C_{18}H_{20}Cl_2N_4O_2S$	128.5-131
115	$C_{20}H_{24}Cl_2N_4O_2S$	OIL
116	$C_{18}H_{16}ClF_5N_4O_2S$	OIL
117	$C_{19}H_{20}ClN_5O_2S$	OIL
118	$C_{18}H_{20}ClN_5O_4S$	OIL
119	$C_{19}H_{23}ClN_4O_2S$	OIL
120	$C_{19}H_{23}ClN_4O_2S$	OIL
121	$C_{19}H_{23}ClN_4O_2S$	106-108.5
125	$C_{22}H_{29}ClN_4O_2S$	107-108.5
126	$C_{20}H_{25}ClN_4O_2S$	OIL
127	$C_{20}H_{25}ClN_4O_2S$	OIL
128	$C_{20}H_{25}ClN_4O_2S$	OIL
129	$C_{20}H_{25}ClN_4O_2S$	OIL
130	$C_{20}H_{25}ClN_4O_2S$	OIL
131	$C_{20}H_{25}ClN_4O_2S$	OIL
132	$C_{21}H_{27}ClN_4O_2S$	OIL
133	$C_{19}H_{20}ClF_3N_4O_2S$	OIL
134	$C_{24}H_{25}ClN_4O_2S$	OIL
135	$C_{25}H_{27}ClN_4O_2S$	OIL
136	$C_{19}H_{23}ClN_4O_3S$	OIL
137	$C_{19}H_{23}ClN_4O_3S$	OIL
138	$C_{19}H_{23}ClN_4O_3S$	OIL
139	$C_{17}H_{20}ClN_5O_2S$	143-146
140	$C_{18}H_{22}ClN_5O_3S$	OIL
141	$C_{24}H_{25}ClN_4O_3S$	OIL
142	$C_{24}H_{31}ClN_4O_2S$	LIQUID
143	$C_{21}H_{25}ClN_8O_2S$	60-69
144	$C_{24}H_{31}ClN_4O_2S$	SEMI SOLID
145	$C_{17}H_{20}ClN_5O_2S$	OIL
146	$C_{18}H_{19}ClF_3N_5O_2S$	OIL
147	$C_{17}H_{19}ClFN_5O_2S$	OIL
148	$C_{18}H_{22}ClN_5O_3S$	OIL
149	$C_{18}H_{19}ClF_3N_5O_3S$	OIL
150	$C_{18}H_{19}ClN_6O_2S$	150-156
151	$C_{17}H_{18}Cl_3N_5O_2S$	OILY SOLID
152	$C_{18}H_{20}ClFN_4O_2S$	OIL
153	$C_{19}H_{20}ClF_3N_4O_3S$	OIL
154	$C_{17}H_{19}Cl_2N_5O_2S$	115-116
155	$C_{17}H_{19}Cl_2N_5O_2S$	OIL
156	$C_{18}H_{22}ClN_5O_3S$	OIL
157	$C_{18}H_{22}ClN_5O_2S$	OIL
158	$C_{20}H_{26}ClN_5O_3S$	OIL
159	$C_{18}H_{23}N_5O_3S$	OIL
160	$C_{19}H_{25}N_5O_4S$	OIL
161	$C_{19}H_{22}F_3N_5O_3S$	OIL
162	$C_{20}H_{26}ClN_5O_3$	93-95

	Molecular Formula	Melting Point (°C) of Solids Or Physical State
163	$C_{19}H_{24}ClN_5O_4S$	OIL
164	$C_{19}H_{25}ClN_6O_3$	144-146
165	$C_{21}H_{29}ClN_6O_3$	OIL
166	$C_{19}H_{24}ClN_5O_3S$	OIL
167	$C_{19}H_{25}N_5O_3S$	OIL
168	$C_{18}H_{22}FN_5O_3S$	OIL
169	$C_{20}H_{26}ClN_5O_4S$	OIL
170	$C_{18}H_{22}BrN_5O_3S$	OIL
171	$C_{20}H_{24}F_3N_5O_4S$	OIL
172	$C_{21}H_{25}F_3N_4O_4S$	OIL
173	$C_{18}H_{20}Cl_2N_4O_3$	SOLID
174	$C_{19}H_{23}ClN_4O_4$	OIL
175	$C_{27}H_{31}ClN_4O_4S_2$	OIL
176	$C_{18}H_{19}Cl_2N_5S$	OIL
177	$C_{19}H_{22}ClN_5OS$	OIL
178	$C_{19}H_{22}ClN_5O$	OIL
179	$C_{19}H_{21}Cl_2N_5O$	FOAM
180	$C_{20}H_{24}ClN_5O_2$	OIL
181	$C_{23}H_{31}ClN_6O$	68-72
182	$C_{24}H_{33}ClN_6O$	OIL
183	$C_{23}H_{31}ClN_6O$	OIL
184	$C_{17}H_{20}ClN_5O_2S$	OIL
187	$C_{17}H_{19}Cl_2N_5O_3$	GUM
188	$C_{18}H_{21}Cl_2N_5O3$	GUM
189	$C_{20}H_{25}Cl_2N_5O_3$	GUM
190	$C_{23}H_{29}Cl_2N_5O_3$	GUM
192	$C_{17}H_{20}ClN_5O_2S$	OIL
198	$C_{17}H_{19}Cl_2N_5O_2S$	107-110
199	$C_{18}H_{21}Cl_2N_5O_2S$	117-118
200	$C_{22}H_{29}Cl_2N_5O_2S$	GUM
201	$C_{18}H_{21}Cl_2N_5O_2S$	93
202	$C_{20}H_{25}Cl_2N_5O_2S$	123
203	$C_{23}H_{29}Cl_2N_5O_2S$	101
204	$C_{20}H_{20}Cl_2F_3N_5O_2S$	GUM
205[1]	$C_{18}H_{23}ClN_5O_2SI$	FOAM
206	$C_{17}H_{20}Cl_2N_6O_2$	137-138
207	$C_{18}H_{22}Cl_2N_6O_2$	149-150
208	$C_{20}H_{26}Cl_2N_6O_2$	72-75
209	$C_{17}H_{20}Cl_2N_6O_3$	SOLID
210	$C_{21}H_{26}Cl_2N_6O_2$	135-136
211	$C_{18}H_{22}Cl_2N_6O_2$	SOLID
212	$C_{20}H_{26}Cl_2N_6O_2$	OIL
213	$C_{17}H_{18}Cl_2N_6S$	140.5-142.5
214	$C_{17}H_{18}Cl_2N_6$	130.5-131.5
216	$C_{16}H_{18}Cl_2N_6O_2S$	110-112
217	$C_{17}H_{20}ClN_5O_2S$	OIL
220	$C_{14}H_{19}ClN_4O_2S$	OIL

	Molecular Formula	Melting Point (°C) of Solids Or Physical State
221	$C_{20}H_{29}ClN_4O_2S$	OIL
222	$C_{15}H_{21}ClN_4O_2S$	OIL
223	$C_{15}H_{21}ClN_4O_2S$	OIL
224	$C_{14}H_{18}Cl_2N_4O_2S$	OIL
225	$C_{14}H_{18}Cl_2N_4O_2S$	OIL
226	$C_{14}H_{17}Cl_3N_4O_2S$	OIL
227	$C_{14}H_{17}Cl_3N_4O_2S$	SOLID
228	$C_{14}H_{17}Cl_3N_4O_2S$	OIL
229	$C_{15}H_{18}ClF_3N_4O_2S$	OIL
230	$C_{20}H_{23}ClN_4O_2S$	OIL
231	$C_{13}H_{18}ClN_5O_2S$	OIL
235	$C_{13}H_{17}Cl_2N_5O_2S$	OIL
242	$C_{14}H_{19}ClN_4O_3$	OIL
243	$C_{14}H_{18}ClN_5S$	OIL
244	$C_{14}H_{17}ClN_4O_3$	114-115
245	$C_{15}H_{19}ClN_4O_3$	107-110
246	$C_{16}H_{21}ClN_4O_4$	106-110
247	$C_{18}H_{25}ClN_4O_5$	84-87
248	$C_{14}H_{17}ClN_4O_2S$	SOLID
249	$C_{14}H_{17}ClN_4O_2S$	125-127
250	$C_{15}H_{20}N_4O_2S$	109-112
251	$C_{15}H_{17}F_3N_4O_2S$	108-110
252	$C_{15}H_{19}ClN_4O_2S$	OIL
253	$C_{15}H_{19}ClN_4O_2S$	123-124
254	$C_{16}H_{21}ClN_4O_2S$	OIL
255	$C_{19}H_{27}ClN_4O_2S$	OIL
256	$C_{20}H_{27}ClN_4O_3$	112-113
257	$C_{20}H_{27}ClN_4O_2S$	OIL
258	$C_{21}H_{29}ClN_4O_2S$	OIL
259	$C_{15}H_{19}ClN_4O_2S$	OIL
260	$C_{19}H_{27}ClN_4O_2S$	OIL
261	$C_{15}H_{20}ClN_5O_2$	OIL
262	$C_{16}H_{22}ClN_5O_2$	OIL
279	$C_{13}H_{16}ClN_5O_2S$	SOLID
285	$C_{14}H_{18}ClN_5O_2S$	SOLID
296	$C_{14}H_{19}N_5O_2S$	SOLID
297	$C_{14}H_{18}ClN_5O_2$	153-155
298	$C_{14}H_{16}ClN_5S$	SOLID
299	$C_{14}H_{17}ClN_6$	OIL
300	$C_{20}H_{21}ClN_4O_2S$	OIL
301	$C_{21}H_{22}Cl_2N_4O_2S$	OIL
302	$C_{20}H_{20}ClFN_4O_2S$	OIL
303	$C_{21}H_{23}ClN_4O_2S$	OIL
304	$C_{18}H_{19}ClN_6O_2S$	103-106
305	$C_{21}H_{22}ClFN_4O_2S$	OIL
306	$C_{24}H_{24}Cl_2FN_5O_2S$	113-120
307	$C_{25}H_{24}ClF_3N_4O_2S$	SEMI-SOLID

	Molecular Formula	Melting Point (°C) of Solids Or Physical State
308	$C_{24}H_{26}ClN_5O_4S$	OIL
309	$C_{31}H_{33}N_5O_5S_2$	OIL
310	$C_{24}H_{26}ClN_5O_3S$	OIL
311	$C_{24}H_{25}Cl_2N_5O_3S$	OIL
312	$C_{25}H_{28}ClN_5O_4S$	OIL
313	$C_{33}H_{35}ClN_4O_5S_2$	OIL
314	$C_{23}H_{22}Cl_3N_5O_2S$	GLASS
315	$C_{23}H_{22}Cl_3N_5O_2S$	149
316	$C_{23}H_{22}Cl_3N_5O_2S$	131
317	$C_{23}H_{22}Cl_3N_5O_2S$	116
318	$C_{23}H_{18}Cl_2F_5N_5O_2S$	GUM
319	$C_{24}H_{25}Cl_2N_5O_2S$	GUM
320	$C_{24}H_{25}Cl_2N_5O_2S$	150
321	$C_{24}H_{25}Cl_2N_5O_2S$	GUM
322	$C_{24}H_{22}Cl_2F_3N_5O_2S$	GUM
323	$C_{24}H_{22}Cl_2F_3N_5O_2S$	GUM
324	$C_{24}H_{22}Cl_2F_3N_5O_2S$	GUM
325	$C_{24}H_{25}Cl_2N_5O_3S$	GLASS
326	$C_{24}H_{25}Cl_2N_5O_3S$	GLASS
327	$C_{24}H_{25}Cl_2N_5O_3S$	137
328	C_{21}H22$ClF_3N_4O_2S$	OIL
329	$C_{21}H_{20}ClF_3N_4O_2S$	124-125
330	$C_{22}H_{22}ClF_3N_4O_2S$	OIL
339	$C_{16}H_{20}ClN_5O_3S_2$	OIL
486	$C_{17}H_{26}N_4O_4S$	OIL
488	$C_{14}H_{21}ClN_6O_2$	OIL
492	$C_{12}H_{16}ClN_5O_2$	SOLID
493	$C_{14}H_{17}ClN_6O_2$	OIL
494	$C_{11}H_{15}ClN_6O_2$	OIL
495	$C_{13}H_{16}ClN_7O_2$	OIL
496	$C_{20}H_{24}ClN_5O_3$	OIL
497	$C_{18}H_{20}Cl_2N_6O_2$	SOLID
498	$C_{19}H_{23}ClN_6O_3$	SOLID
499	$C_{19}H_{21}Cl_2N_5O_2$	FOAM
501	$C_{19}H_{21}Cl_2N_5O_2$	OIL
504	$C_{21}H_{26}ClN_5O_4$	FOAM
519	$C_{15}H_{20}ClN_5O_2$	OIL
520	$C_{14}H_{19}ClN_6O_2$	OIL
524	$C_{14}H_{17}ClN_6O_2$	OIL
525	$C_{15}H_{18}ClN_5O_2$	OIL
526	$C_{16}H_{20}ClN_5O_2$	OIL
527	$C_{12}H_{17}ClN_6O_3$	OIL
528	$C_{13}H_{19}ClN_6O_3$	130-132
529	$C_{12}H_{17}ClN_6O_2S$	OIL
530	$C_{13}H_{19}ClN_6O_2S$	OIL
531	$C_{13}H_{20}ClN_7O_2$	OIL
532	$C_{14}H_{22}ClN_7O_2$	OIL

	Molecular Formula	Melting Point (°C) of Solids Or Physical State
534	$C_{13}H_{16}ClN_7O_3$	OILY SOLID
535	$C_{14}H_{18}ClN_7O_3$	122-124
536	$C_{13}H_{16}ClN_7O_2S$	135-138
537	$C_{14}H_{18}ClN_7O_2S$	SOLID
538	$C_{14}H_{19}ClN_8O_2$	129-131
539	$C_{15}H_{21}ClN_8O_2$	122-125
540	$C_{19}H_{22}Cl_2N_6O_3$	SYRUP
542	$C_{19}H_{23}ClN_6O_3$	OIL
543	$C_{19}H_{23}ClN_6O_3$	OIL
544	$C_{19}H_{23}ClN_6O_4$	OIL
545	$C_{20}H_{25}ClN_6O_4$	115-120
546	$C_{21}H_{28}ClN_7O_3$	SYRUP
548	$C_{18}H_{21}Cl_2N_7O_3$	SYRUP
555	$C_{14}H_{19}ClN_6O_3$	OIL
556	$C_{15}H_{21}ClN_6O_3$	OIL
558	$C_{14}H_{17}ClN_6O_3$	OILY-SOLID
559	$C_{14}H_{17}ClN_6O_2S$	129-132
560	$C_{15}H_{19}ClN_6O_2S$	105-108
561	$C_{15}H_{20}ClN_7O_2$	114-117
562	$C_{16}H_{22}ClN_7O_2$	107-109
563	$C_{10}H_{15}ClN_6O_3S$	OIL
564	$C_{11}H_{17}ClN_6O_3S$	85-87
565	$C_{11}H_{14}ClN_7O_3S$	76-80
566	$C_{12}H_{16}ClN_7O_3S$	OIL
567	$C_{13}H_{15}Cl_2N_7O_3S_2$	OIL
568	$C_{14}H_{17}Cl_2N_7O_3S_2$	SOLID
569	$C_{12}H_{15}ClN_6O_3S$	159-162
570	$C_{13}H_{17}ClN_6O_3S$	160-161
571	$C_{15}H_{27}N_5O_5$	Oil
572	$C_{16}H_{29}N_5O_5$	Oil
573	$C_{18}H_{27}N_5O_5$	Oil
574	$C_{19}H_{29}N_5O_5$	Oil
575	$C_{13}H_{21}N_5O_4$	80-84
576	$C_{14}H_{23}N_5O_4$	110-114
577	$C_{13}H_{16}ClN_5S$	108-110
578	$C_{12}H_{16}ClN_5O_2S$	86-89
579	$C_{13}H_{17}ClN_4O_2S$	Syrup

Candidate insecticides were evaluated for activity against the tobacco budworm (Heliothis virescens [Fabricius]) in a surface-treated diet test.

In this test one mL of molten (65-70°C) wheat germ-based artificial diet was pipetted into each well of a four by six (24 well) multi-well plate (ID# 430345-15.5 mm dia. x 17.6 mm deep; Corning Costar Corp., One Alewife Center, Cambridge,

MA 02140). The diet was allowed to cool to ambient temperature before treatment with candidate insecticide.

For a determination of insecticidal activity, solutions of the candidate insecticides were prepared for testing using a Packard 204DT Multiprobe® Robotic System (Packard Instrument Company, 800 Research Parkway, Meriden, CT 06450), in which the robot first diluted a standard 50 millimolar DMSO solution of candidate insecticide with a 1:1 water/acetone solution (V/V) in a ratio of 1:7 stock solution to water/acetone. The robot subsequently pipetted 40 microliters of the so-prepared solution onto the surface of the diet in each of three wells in the 24 multi-well plate. The process was repeated with solutions of seven other candidate insecticides. Once treated, the contents of the multi-well plate were allowed to dry, leaving 0.25 millimoles of candidate insecticide on the surface of the diet, or a concentration of 0.25 millimolar. Appropriate untreated controls containing only DMSO on the diet surface were also included in this test.

For evaluations of the insecticidal activity of a candidate insecticide at varying rates of application, the test was established as described above using sub-multiples of the standard 50 millimolar DMSO solution of candidate insecticide. For example, the standard 50 millimolar solution was diluted by the robot with DMSO to give 5, 0.5, 0.05, 0.005, 0.0005 millimolar, or more dilute solutions of the candidate insecticide. In these evaluations there were six replicates of each rate of application placed on the surface of the diet in the 24 multi-well plate, for a total of four rates of application of candidate insecticide in each plate.

In each well of the test plate was placed one second instar tobacco budworm larvea, each weighing approximately five milligrams. After the larvae were placed in each well, the plate was sealed with clear polyfilm adhesive tape. The tape over each well was perforated to ensure an adequate air supply. The plates were then held in a growth chamber at 25 °C and 60% relative humidity for five days (light 14 hours/day).

After the five-day exposure period insecticidal activity for each rate of application of candidate insecticide was assessed as percent inhibition of insect weight relative to the weight of insects from untreated controls, and percent mortality when compared to the total number of insects infested.

Insecticidal activity data at selected rates of application from this test are provided in Table 3. The test compounds of formula **I** are identified by numbers that correspond to those in Table 1.

Table 3

Insecticidal Activity of Certain N-(Heteroarylalkyl)alkanediamine Derivatives When Applied to the Surface of the Diet of Tobacco Budworm (*Heliothis virescens* [Fabricius])

Cmpd No.	Percent Mortality	Percent Growth Inhibition	Cmpd No.	Percent Mortality	Percent Growth Inhibition
1	83	100	2	100	100
3	50	96	4	100	100
5	100	100	6	67	95
7	67	99	8	50	100
9	50	91	10	17	90
14	50	100	15	17	85
17	67	99	18	33	100
19	100	100	40	83	100
41	83	100	44	83	100
46	0	78	54	0	67
65	67	100	66	0	73
71	33	100	100	50	99
101	83	100	102	100	100
103	100	100	104	100	100
105	100	100	106	67	100
107	100	100	108	67	50
109	83	100	110	0	50
111	17	87	115	100	100
116	100	100	119	67	87
120	17	93	125	100	100
126	50	85	127	33	78
129	50	85	132	50	92
134	100	100	135	100	100
136	0	50	141	100	100
142	50	93	143	67	93
144	100	100	151	33	83
154	33	75	173	0	76
174	17	86	184	17	82
187	0	50	189	100	100
190	100	100	192	83	92
198	33	50	202	100	100
203	100	100	217	17	81
220	100	100	221	100	100
222	100	100	223	83	98
224	100	100	225	17	89
226	100	100	227	17	92
228	83	100	229	100	96
230	33	88	231	67	100
242	83	96	244	83	100
245	50	100	246	100	100
247	100	100	248	100	100
249	83	99	252	100	100
253	83	100	254	100	100

Cmpd No.	Percent Mortality	Percent Growth Inhibition	Cmpd No.	Percent Mortality	Percent Growth Inhibition
255	50	88	256	100	100
257	100	100	258	100	100
279	83	100	301	100	100
302	50	97	304	0	61
307	100	100	310	50	100
311	50	100	314	100	100
315	83	98	317	100	100
318	100	100	319	100	10
320	100	96	321	100	100
322	100	100	323	10	100
324	100	100	325	100	100
326	100	100	327	83	100
328	83	98	558	33	85

Concentration of the candidate insecticide on the surface of the diet is 0.25 millimolar.

As set forth in Table 3, all of the tested compounds of the present invention provided insecticidal activity against the tobacco budworm, with many of the compounds providing 100% mortality and/or 100% growth inhibition.

Candidate insecticides were also evaluated for insecticidal activity by observing mortality in a population of cotton aphid (*Aphis gossypii*) on treated cotton plants when compared to like populations of cotton aphid on untreated plants. These tests were conducted in the following manner:

For each rate of application of test compound, two seven-to-ten days old cotton seedlings (*Gossypium hirsutium*) grown in 7.6 cm diameter pots were selected for the test. Each test plant was infested with about 120 adult cotton aphids by placing onto each test plant cuttings of leaves from cotton plants grown in a cotton aphid colony. Once infested, the test plants were maintained for up to about 12 hours to allow complete translocation of the aphids onto the test plant. A solution comprising 1000 part per million (ppm) of each test compound was prepared by dissolving 10 milligrams of the test compound in 1 mL of acetone. Each solution was then diluted with 9 mL of a solution of 0.03 mL of polyoxyethylene(10) isooctylphenyl ether in 100 mL of water. About 2.5 mL of solution of each test compound was needed to spray each replicate of test plant (5 mL total for each test compound). If needed, the solution of 1000 ppm of test compound was serially diluted with a solution of 10% acetone and 300 ppm of

polyoxyethylene(10) isooctylphenyl ether in water to provide solutions of each test compound for lower rates of application, for example, 300 ppm, 100 ppm, 30 ppm, or 10 ppm. Each replicate of test plant was sprayed with the solutions of test compound until run-off on both the upper and lower surfaces of the leaves. All the test plants were sprayed using a DeVilbus Atomizer Model 152 (Sunrise Medical, Carlsbad, CA) at a pressure of about 0.63-0.74 kilogram per square centimeter from a distance of about 30.5 centimeters from the test plants. For comparison purposes, a solution of a standard, such as amitraz or demethylchlordimeform (DCDM), prepared in a manner analogous to that set forth above, as well as a solution of 10% acetone and 300 ppm of polyoxyethylene(10) isooctylphenyl ether in water containing no test compound were also sprayed onto test plants. Upon completion of spraying the solutions of test compound, the solution of standard, and the solution containing no test compound, the plants were allowed to dry. Upon completion of drying, the test plants were placed in a tray containing about 2.5 centimeters of water, where they were maintained in a growth chamber for 24 hours. After this time, each plant was assessed for percent mortality caused by the test compound when compared to the population of aphids that was infested onto the test plants prior to treatment with test compound. A test compound was designated as possessing insecticidal activity (SA) if there was 20% to 75% mortality of cotton aphid on plants sprayed with that compound. If there was 75% mortality or greater of the cotton aphid, a test compound was designated as being more insecticidally active (A). If there was 20% mortality or less of the cotton aphid, the test compound was termed as inactive (I).

An assessment of the insecticidal activity at selected rates of application from this test is provided in Tables 4 and 4A. Again, the test compounds of formula I are identified by numbers that correspond to those in Table 1.

Table 4

The following Compounds of The Present Invention Reduced the Population of Cotton Aphid by At Least 75% when Applied at an Application Rate of 1000ppm or Less

Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.
1	2	3	4	5[1]	6	7	8	9	14
15	16	17	18	19	20	38	39	40	41
42	44	46	51	54	65	66	68	69	70
71	72	73	74	96	97	99	100	101	102
103	104	105	106	107	108	109	110	111	112
115	116	117	118	119	120	121	126	127	128
129	130	131	132	133	134	135	136	137	140
141	142	143	144	146	147	148	149	150	151
152	153	154	155	156	157	158	159	160	161
162	163	164	165	166	167	168	169	170	173
174	177	178	184	187	188	189	190	192	198
199	200	201	202	203	204	206	207	208	209
210	211	212	213	214	216	217	220	221	222
223	224	225	226	227	228	229	230	231	235
243	244	245	246	247	248	249	250	251	252
253	254	255	256	257	258	259	260	261	262
279	285	296	298	299	300	301	302	303	304
305	306	307	310	311	312	314	315	316	317
318	319	320	321	322	323	324	325	326	327
329	330	339	486	488	501	527	528	529	530
531	532	534	535	540	542	543	544	545	548
555	556	558							

[1]96 hr exposure period; all others 72 hr exposure period

Table 4A

The following Compounds of The Present Invention Reduced the Population of Cotton Aphid Between 20% and 75% when Applied at an Application Rate of 1000ppm or Less

Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.	Cmpd. No.
75	98	180	181	183	205	297	504	525	526
538	539	546							

72 hr exposure period

As set forth in Tables 4 and 4A, most of the tested compounds of the present invention reduced the aphid population by at least 75% at an application rate of 1000ppm or less. A small number of tested compounds of the present invention reduced the aphid population by 20% to 75% at an application rate of 1000ppm or less.

While this invention has been described with an emphasis upon preferred embodiments, it will be understood by those of ordinary skill in the art that variations of the preferred embodiments may be used and that it is intended that the invention may be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications encompassed within the spirit and scope of the invention as defined by the following claims.